

MiniCoder GEL 2444K

Speed and position sensor with metal housing and sin/cos output

Technical information

Version 01.12



General

- ▶ The measuring unit comprises a sensor and a precision target wheel for attachment to shafts with a shaft diameter from 8 mm to over 500 mm
- ▶ Rotational speed and position acquisition by means of contactless scanning of precision target wheels using magnetoresistive sensor elements
- ▶ Output signals are two sinusoidal signals offset by 90° for the detection of direction (tracks 1 and 2) and their inverse signals, optionally with a reference pulse (track N).
- ▶ High resolution and accuracy of the incremental hollow shaft measuring system by interpolation of the sensor signals
- ▶ **Safety integrated** certificate

Features

- ▶ Output signal 1 V_{pp} with high signal quality (sin/cos)
- ▶ Frequency range from 0 to 200 kHz
- ▶ Speed measurement range from 0 to 100,000 min⁻¹
- ▶ Temperature range -40 to +120°C
- ▶ Protection class IP 68

Advantages

- ▶ Easy mounting due to amplitude regulation (optional)
- ▶ Extremely robust due to full encapsulation of the MiniCoder
- ▶ Low temperature drift and high signal quality due to usage of optimised GMR sensors
- ▶ Highest immunity to interference due to fully screened metal housing
- ▶ New tangential cable outlets provide new integration options for the sensor
- ▶ Customer-specific manufacture of precision target wheels for simple implementation

Field of application

- ▶ Machine tool engineering
 - Position and speed acquisition in HSC spindles (High Speed Cutting)
 - Electronic synchronisation of screw spindles in vacuum pumps
 - Position and speed acquisition in milling spindles and grinding spindles
- ▶ Speed and position measurement in test stands, motors (hybrid drives, torque motors)

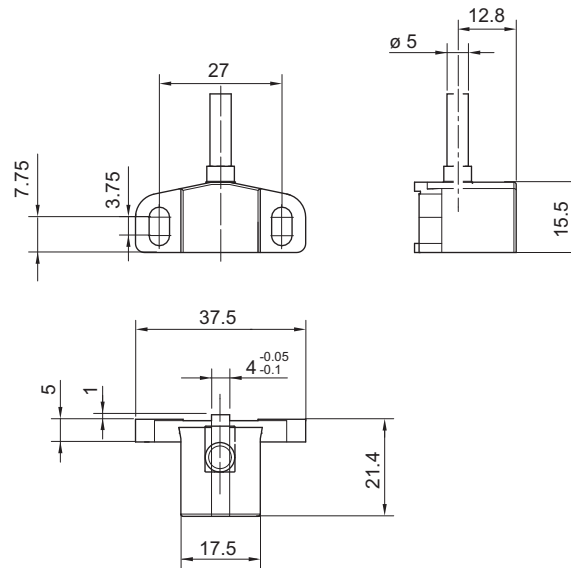
Technical data

Electrical data	
Supply voltage V_S	5 V DC \pm 5%, polarity reversal protected, overvoltage protected
Output level	1 V _{pp} Differential signal
Output signal	Two sinusoidal signals offset by 90° and their inverse signals, short-circuit-proof; option: reference pulse
Output frequency	0 to 200 kHz ⁽¹⁾
Power consumption without load	\leq 0.3 W
Electromagnetic compatibility	EN 61000–6–1 to 4
Insulation strength	500 V, in accordance with EN 60439–1
Mechanical data	
Air gap permitted	0.5 mm \pm 0.3 at module 1.0 0.20 mm \pm 0.03 mm at module 0.5 0.15 mm \pm 0.02 mm at module 0.3
Target wheel material	Ferromagnetic steel
Working temperature range	-30 °C to +85 °C
Operating and storage temperature range	-40 °C to +120 °C
Protection class	IP 68
Vibration resistance	200 m/s ² , in accordance with DIN EN 60068-2-6
Shock resistance	2000 m/s ² , in accordance with DIN EN 60068-2-27
Weight	30 g
Housing material	Die cast zinc
Electrical connection	
Number of cores x cable cross-section	9 x 0.14 mm ²
Max. permitted cable length	100 m ⁽²⁾
Cable diameter	5 mm
Min. bending radius	25 mm

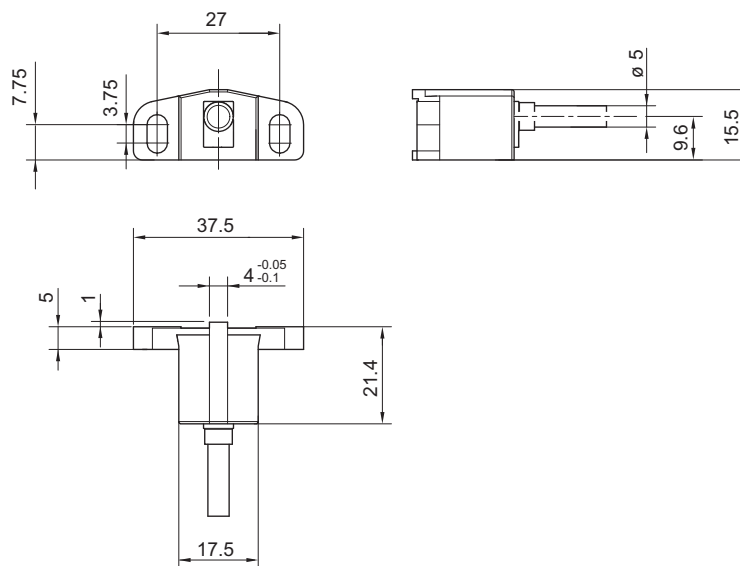
⁽¹⁾ At a cable capacitance of 5 nF

⁽²⁾ Pay attention to the voltage drop on the supply cable

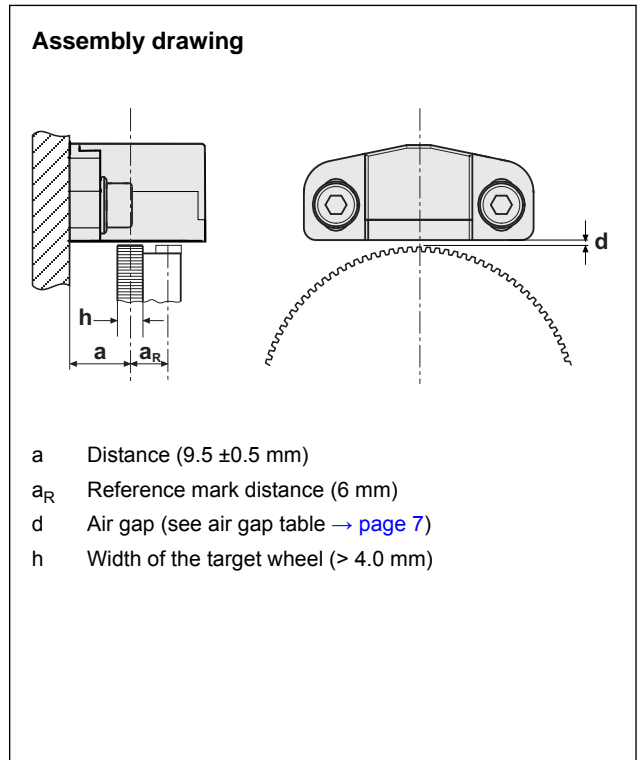
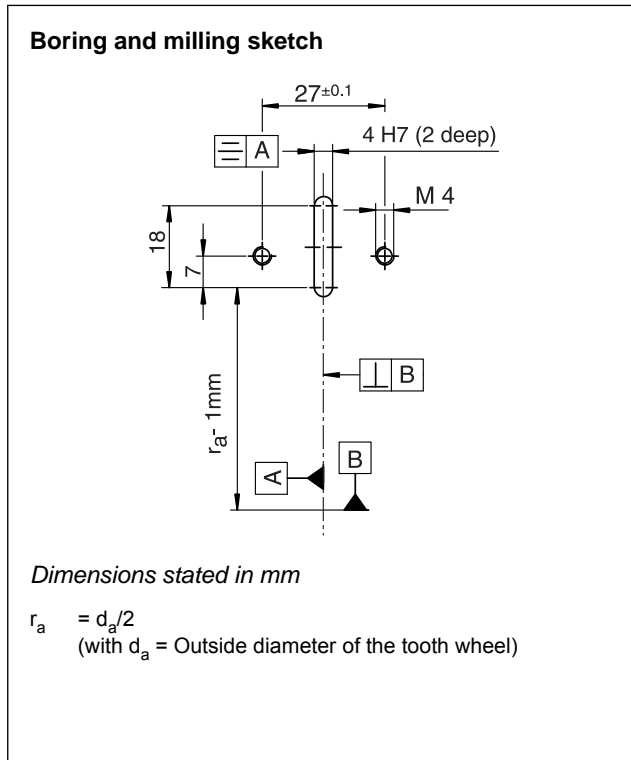
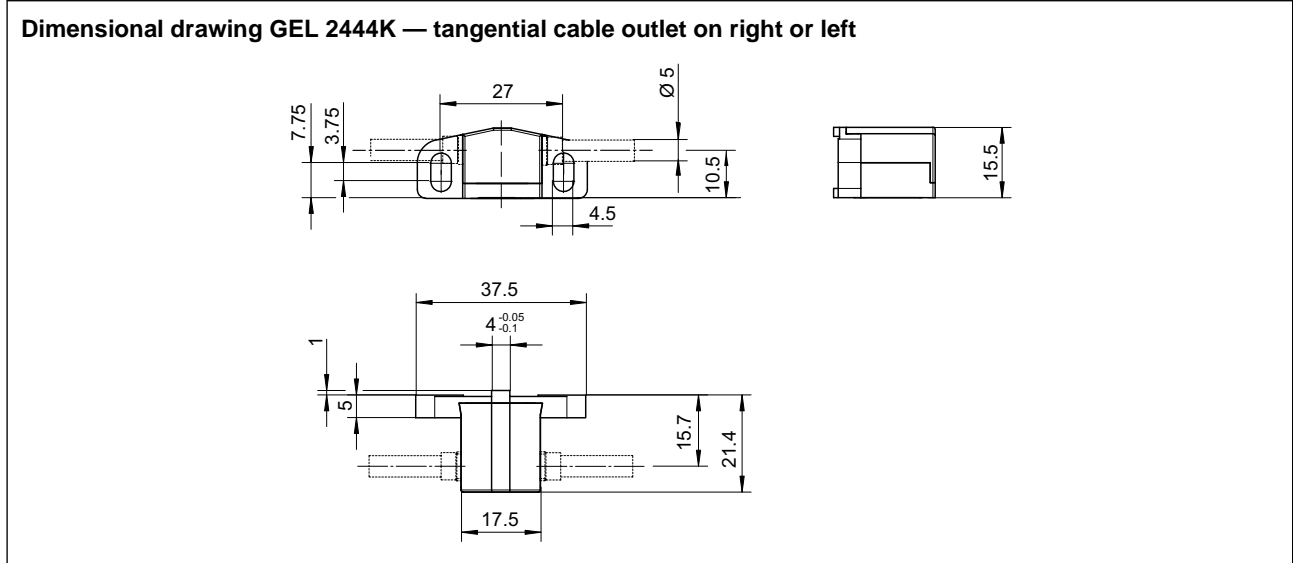
Dimensional drawing GEL 2444K — radial cable outlet



Dimensional drawing GEL 2444K — axial cable outlet



Dimensional drawing



2444	Signal pattern	
	K	Sin/cos signals 1 V _{pp}
	Reference mark	
	– None	
	N	Flag
	M	Groove
	Z	Reference tooth (recommended)
	Internal regulation	
	1	Without internal regulation
	R	With internal amplitude regulation
Cable outlet		
R	Radial	
G	Axial	
T	Tangential, cable outlet right (viewed on the mounting surface)	
L	Tangential, cable outlet left (viewed on the mounting surface)	
Module		
1	Scanning of target wheels with module M = 1	
3	Scanning of target wheels with module M = 0.3	
5	Scanning of target wheels with module M = 0.5	
Connection type		
K	Flying lead (fixed length: 30, 150, 250 or 600 cm)	
N	17-pin receptacle straight, with EMC screening, strain relief and sealing, IP 67 (connected) ⁽¹⁾	
M	17-pin receptacle angled, with EMC screening, strain relief and sealing, IP 67 (connected) ⁽¹⁾	
Cable length L		
Stated in cm: 030, 150, 250 or 600		
Cable for temperature sensor (2 m)		
– None		
M	With	

⁽¹⁾ (state cable length in cm)

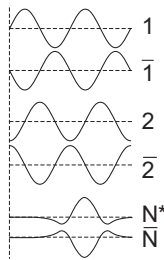
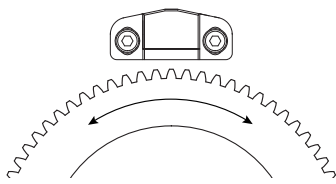
Description

General

MiniCoders and precision target wheels form a unit for the acquisition of rotary movements. The MiniCoder scans the ferromagnetic target wheel. The magnetic field from the MiniCoder is modulated by the rotating target wheel. The integrated sensors and electronics convert this change into sinusoidal output signals.

Signal pattern

The output signals are two sine/cosine signals offset by 90° for the detection of direction (tracks 1 and 2) and their inverse signals, signal pattern K.



N* Reference signal (track N) optional

To evaluate a reference signal a reference mark (option) on the target wheel is required. The position of the reference mark defines the phase position of the reference signal in relation to the track signals.

Reference marks

The selection of the reference mark is defined by the outside diameter and rotational speed of the target wheel used, as both parameters have an effect on the forces acting on the reference mark. In case of new designs we recommend the usage of a target wheel with reference mark variant "Z". Reference marks can be designed as a groove or flag.

Reference mark N – flag

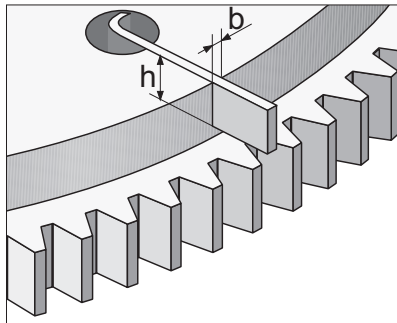
A metal flag integrated into the target wheel and that is positioned exactly between two teeth is detected. This reference pulse can be used for referencing the position. This feature is necessary for example for automatically changing a tool in a milling spindle or grinding spindle.

Reference mark M – groove

Depending on the size and geometry of the target wheel, it is only allowed to design the target wheel with a reference flag up to certain rotational speeds. At rotational speeds above 30,000 min⁻¹ a MiniCoder is used that detects a reference groove integrated into the target wheel. In this case the target wheel is made up of two pieces for technical reasons.

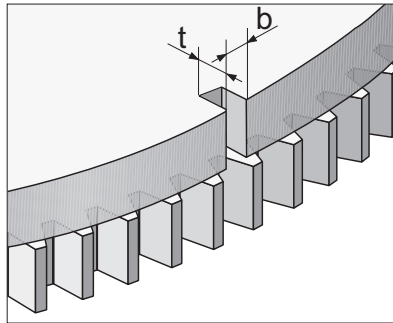
Reference mark Z – tooth at tooth

This MiniCoder design makes it possible to scan a target wheel manufactured from a single piece. With this system rotational speeds in excess of 100,000 min⁻¹ are achievable. For technical reasons the reference mark is flush with a tooth.



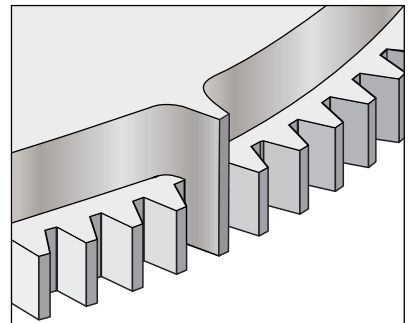
N = Reference mark – flag

h = 4 mm
b = 0.5 mm



M = Reference mark – groove

t = 1 mm,
b = 1.2 mm for module 0.3
b = 1.6 mm for module 0.5
b = 3.0 mm for module 1.0



Z = Reference mark – tooth

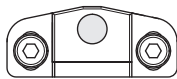
Internal regulation

The MiniCoder can be supplied with or without internal regulation.

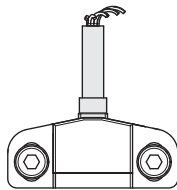
The MiniCoder with internal regulation (option R) regulates fluctuations in the sin/cos amplitudes on changes in the air gap and temperature.

As a result mounting is significantly simplified. It is not necessary to re-adjust the MiniCoder to optimise the signals.

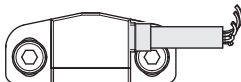
Cable outlet



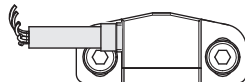
*Axial cable outlet **G***



*Radial cable outlet **R***



*Tangential cable outlet on right **T***



*Tangential cable outlet on left **L***

Module

The module describes the relationship between the number of teeth and the outside diameter of a target wheel.

Air gap table

Type	Module	Air gap d , adjusting measure	Distance tolerance
3	0.3	0.15 mm	± 0.02 mm
5	0.5	0.20 mm	± 0.03 mm
1	1.0	0.50 mm	± 0.3 mm

To make mounting easier, a corresponding gauge is included with the MiniCoder.



The MiniCoder must be ordered to suit the target wheel.

Cable length

With the connection type **K** (flying lead) there are 4 cable lengths available: 30, 150, 250, 600 cm. On the fabrication of the connection cable with a receptacle the cable length in cm is to be stated.

Type of cable PUR cable, screened, 9×0.15 mm²
 Outside diameter: 5 mm (- 0.3)
 Min. bending radius: 25 mm

Cable for temperature sensor (2 m)

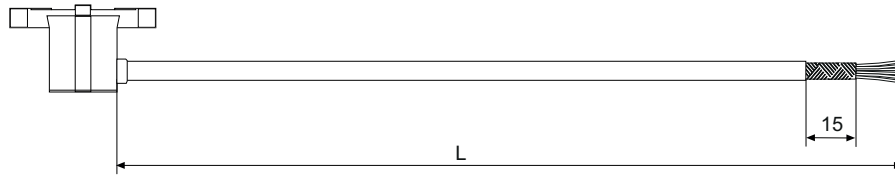
Upon request on the delivery of the connection types **M** and **N** the cable for the temperature sensor is connected to the receptacle (see → [page 9](#)).

Type of cable TEFLON cable, 2×0.14 mm²
 Outside diameter: 2.8 mm (± 0.1)
 Min. bending radius: 20 mm

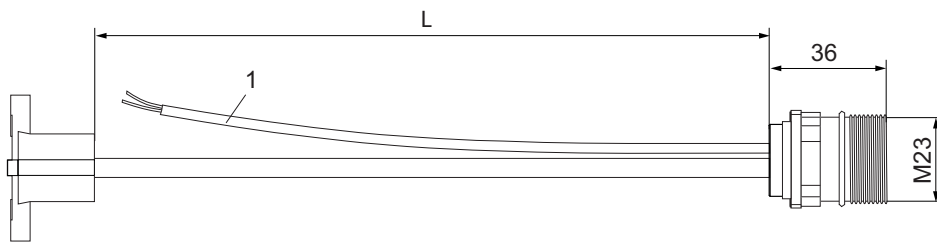
Description

Connection type

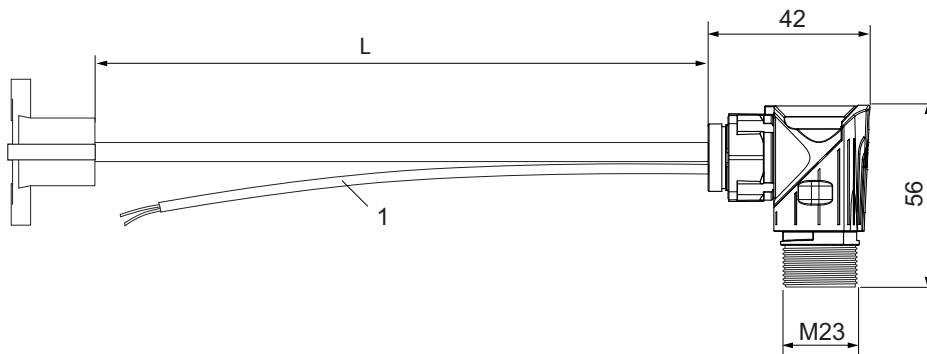
The MiniCoders are supplied with a flying lead, type **K**, or with a 17-pin receptacle M23 (male connector), type **N**, or **M**.



Connection type **K** – flying lead



Connection type **N** 17-pin receptacle, straight



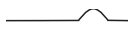


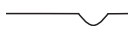


Connection type **M** 17-pin receptacle, angled



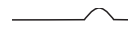





Key

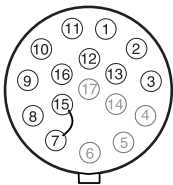
- 1 Cable for temperature sensor option **M** (2-core, length 2 m)
- L Cable length (see type code)

Connection type K

Flying lead	Core colour		Signal/ function	
	white	V_{1+}	Track 1	
brown	V_{1-}	/Track 1		
grey	V_{N+}	Reference track		
blue	0 V	GND		
red	V_S	+ 5 V supply		
pink	V_{2+}	Track 2		
black	V_{2-}	/Track 2		
yellow	V_{N-}	/Reference track		
green	V_{Sense}	5 V Sense		

Connection type N and M

17-pin receptacle	Core colour		Pin		Signal / function	
	white	1	V_{1+}	Track 1		
brown	2	V_{1-}	/Track 1			
grey	3	V_{N+}	Reference track			
	4 – 6	Not used				
blue	7	0 V	GND			
(brown) ⁽¹⁾	8	$\vartheta+$	Temperature +			
(blue) ⁽¹⁾	9	$\vartheta-$	Temperature –			
red	10	V_S	+ 5 V supply			
pink	11	V_{2+}	Track 2			
black	12	V_{2-}	/Track 2			
yellow	13	V_{N-}	/Reference track			
	14	Not used				
–	15	0 V	GND	Jumper pin 7		
green	16	V_{Sense}	5 V Sense			
	17	Not used				



⁽¹⁾ Option: temperature sensor cable

Accessories

Test device

For the correct function of the MiniCoder, exact adjustment and compliance with the tolerances is necessary. The sine and cosine signals from the MiniCoder can be checked using the test device GEL 210 to ensure the signal level is correct. On the 3½-digit, backlit LC display the following measured parameters can be displayed:

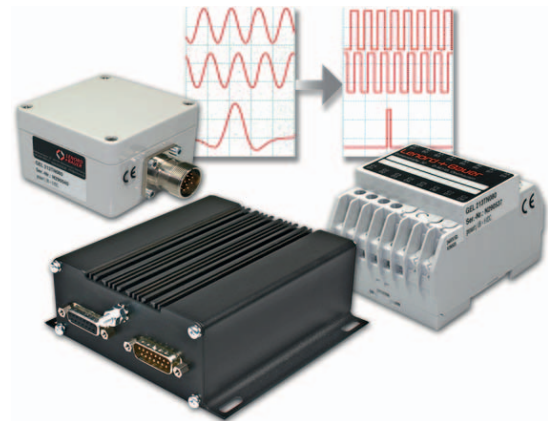
- ▶ Amplitude values for the sine and cosine track
- ▶ Offset values for the two signal tracks
- ▶ Phase offset referred to 90° between the signal tracks
- ▶ Correct function of the reference signal (amplitude and offset)
- ▶ Reference signal position detection

The values measured can be compared with the tolerances specified and in this way checked appropriately.



Interpolation electronics

On the MiniCoder the interpolation of the 1 Vpp output signals is normally undertaken by the control system used. If the control system cannot perform this task, Lenord + Bauer can supply dedicated interpolation electronics with the series GEL 212 / GEL 213 / GEL 214. These convert the 1 Vpp output signals into TTL square-wave signals (maximum interpolation factor = 512). Please request the related documentation or refer to our web site www.lenord.de. The related documentation is also available for download there.



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Subject to technical modifications and typographical errors.
The latest version can be downloaded at www.lenord.de.



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