



General

- ▶ The measuring system comprises a scanning unit, the MiniCODER plus and a precision target wheel
- ▶ Precision target wheels for attachment to shafts with a shaft diameter from 8 mm to over 500 mm are to be ordered separately
- ▶ Magneto-resistive sensors contactlessly scan the target wheel and acquire the rotational speed
- ▶ Output signals are sin/cos signals and their inverse signals
- ▶ Position acquisition by means of the evaluation of a reference mark (digital reference signal)
- ▶ Acquisition of the minimum and maximum temperature in sensor
- ▶ Configurable operating hours counter with seven speed ranges
- ▶ **Safety integrated** certificate
- ▶ Automatic signal calibration using the testing and programming unit (see [Accessories](#), → [page 11](#))
- ▶ Possible to read serial number and type designation

Features

- ▶ Output signal: 1 V_{pp} Differential signal with high signal quality (sin/cos), reference pulse
- ▶ Frequency range: 0 ... 200 kHz
- ▶ Protection class:

Advantages

- ▶ Quick assembly and commissioning due to straightforward checking and setting of the parameters in the assembled state using the testing and programming unit without the need to open the spindle
- ▶ Transparent load monitoring due to integrated operating hours counter and data store
- ▶ Physically compatible with all other MiniCODER versions

Field of application

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

Description

Construction

The measuring unit comprises a scanning unit and a precision target wheel. The system does not need dedicated bearings for this task, as the target wheel is mounted directly on the shaft. The system operates contactlessly and is extremely compact. It acquires the rotational speed and position of the rotating shaft.

Sensors, magnet and electronics are manufactured using the latest micro system technology and are fully encapsulated, as such they are particularly resistant to shocks and vibration. The system is free of maintenance and wear. The MiniCODER plus is physically compatible with the MiniCODER comfort with axial cable outlet. The axial cable outlet permits flexible cable laying, during this process the minimum bending radius is to be observed.

Using the testing and programming unit the MiniCODER plus can be checked and the parameters configured in the assembled state, i.e. without opening e.g. the spindle.

This unit is connected via the connection cable and is available as an accessory (see [Accessories](#), → page 11).

Sensing principle

The MiniCODER contains a magnet. The sensor scans the ferromagnetic target wheel. The magnetic field is changed by the rotating target wheel; these changes are acquired by the sensor element. The integrated electronics convert the changes in the magnetic field into sin/cos signals and output the signals to external electronics.

Functionality

The following extended functions are available after the connection of the testing and programming unit:

Automatic sensor calibration

- ▶ Optimising the amplitude synchronism
- ▶ Stepwise reduction/increase in the amplitudes of the sin/cos signals
- ▶ Minimising the offset on the sin/cos signals
- ▶ Preparing a report
- ▶ Commissioning wizard for the optimisation of the assembly times



For the correct function of the automatic signal calibration, careful assembly and compliance with the tolerances is necessary.

Configurable operating hours counter

- ▶ Defining 7 speed ranges
- ▶ Saving and retrieving the operating hours
- ▶ Saving and retrieving the number of start-ups
- ▶ Preparing a report

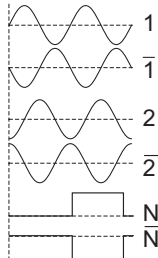
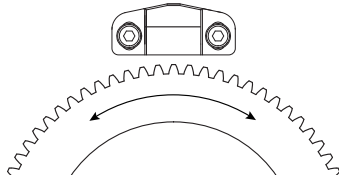
Information saved in the sensor

- ▶ Reading the spindle number (assignment of the spindle)
- ▶ Reading the type code and serial number for the identification of the sensor
- ▶ Total operating time of the sensor
- ▶ Temperature peaks in the sensor: highest and lowest measured temperature

Options

Signal pattern

The output signals are sin/cos signals for the detection of the direction (tracks 1 and 2) and their inverse signals, signal pattern K.



N Reference signal
The phase position of the reference signal in relation to track signals is dependent on the reference mark.

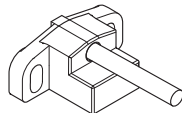
Reference marks

To generate a reference signal a reference mark is required on the target wheel (see [Explanations about the target wheel](#), → page 10).

The MiniCODER plus evaluates the following reference marks: flag, groove, tooth ⁽¹⁾.

Cable outlet

The MiniCODER plus is available with the following cable outlet:



Axial cable outlet G

Module

The MiniCODER must be ordered to suit the module of the target wheel (see [Explanations about the target wheel](#), → page 10), module available: 0.3 / 0.5 .

Connection type

The following connection types are available:

- ▶ Flying lead type **K**
- ▶ 17-pin panel-mounting socket, straight, M23 (male connector) type **N**
- ▶ 17-pin panel-mounting socket, angled, M23 (male connector) type **M**

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 panel-mounting socket the cable length in cm is to be stated.

For more detailed information on the type of cable and properties see [Technical data](#) (→ page 4).

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 panel-mounting socket (see → page 8).

Type of cable TEFLON cable, 2 x 0.14 mm²

Outside diameter: 2.8 mm (± 0.1)

Min. bending radius: 20 mm

⁽¹⁾ In case of new designs recommended

Technical data

General 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	sin/cos signals and their inverse signals, short-circuit-proof; 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	
Weight	30 g
Housing material	Die cast zinc
Working temperature range	-0 °C to +85 °C
Operating and storage temperature range	-40 °C to +120 °C
Protection IP code	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
Electrical connection	
Number of cores x cable cross-section	9 x 0.15 mm ²
Max. permitted cable length	100 m ⁽²⁾
Cable diameter	5 mm (- 0.3)
Minimum bending radius (static / dynamic)	10 mm / 25 mm

Target wheel data

Sensor type	GEL 2444K_PG3	GEL 2444K_PG5
Target wheel		
Module	0.3	0.5
Permitted air gap	0.15 mm \pm 0.02 mm	0.20 mm \pm 0.03 mm
Width of the measuring track (sin/cos)	\geq 4.0 mm	
Centre distance between the sensor elements (sin/cos to reference track)	6 mm	
Material	ferromagnetic steel	
Reference mark	flag, groove, tooth ⁽³⁾	

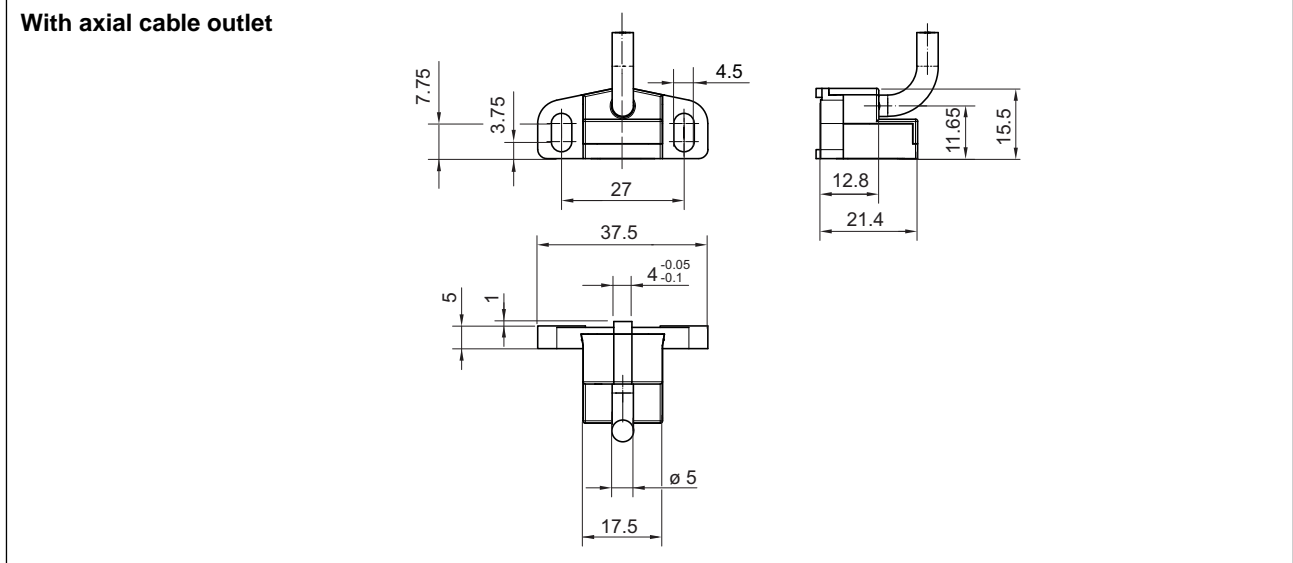
(1) At a cable capacitance of 5 nF

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

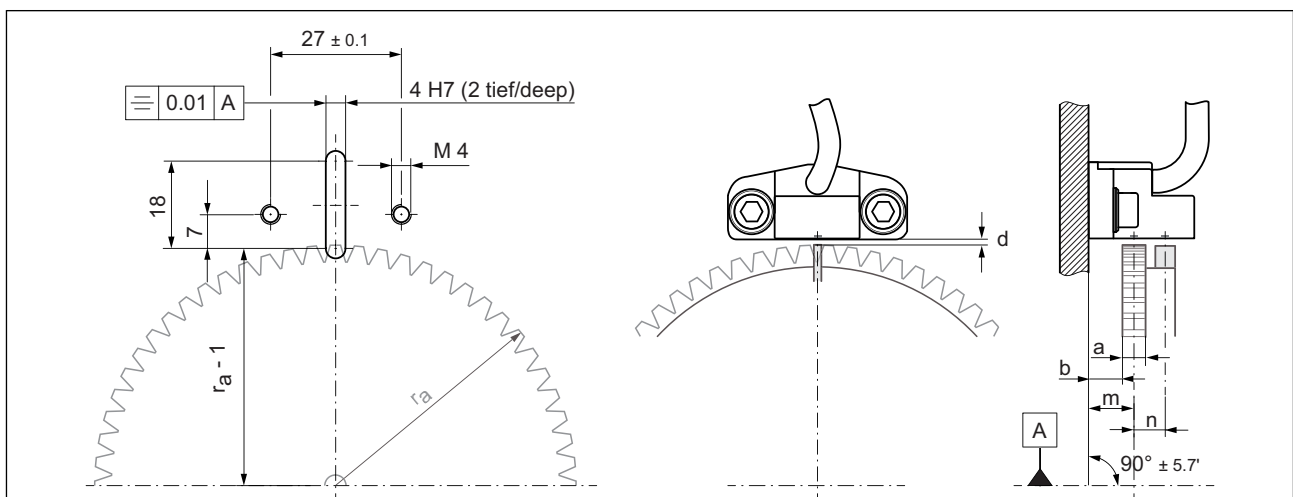
(3) In case of new designs recommended

Dimensional drawing

Dimensional drawings GEL 2444K_P



Hole pattern and installation dimensions



All dimensions stated in mm

- a Width of the measuring track: ≥ 4.0 mm
- b Distance installation surface – tooth wheel: dependent on the geometry of the target wheel and width of the measuring track
- d Air gap: dependent on the module (see air gap table)
- m Distance installation surface – middle of the measuring track: $9.5 \text{ mm} \pm 0.5 \text{ mm}$
- n Centre distance between the sensor elements (sin/cos to reference track): 6 mm
- $r_a = d_a/2$ (with $d_a = \text{OD of the tooth wheel}$)

Air gap table

Module option	Module	Air gap d , preset measure \pm distance tolerance
3	0.3	0.15 mm \pm 0.02 mm
5	0.5	0.20 mm \pm 0.03 mm

To make assembly easier, a corresponding distance gauge is included with the MiniCODER.

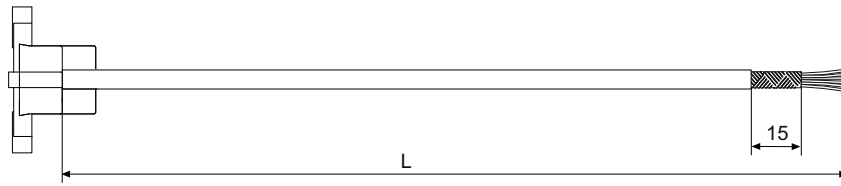
Type code

Type code MiniCODER plus

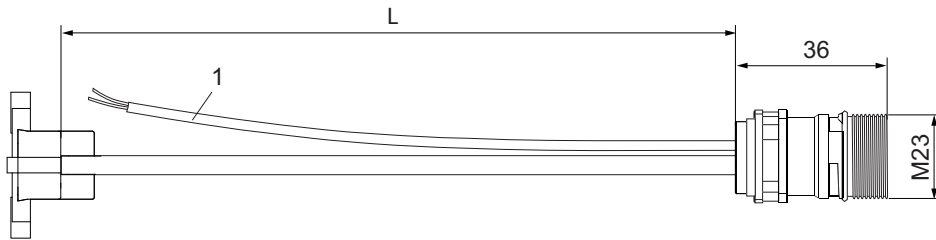
	Signal pattern
K	Sin/cos signals 1 V _{pp}
	Reference mark
N	Flag
M	Groove
Z	Reference tooth (recommended)
	Internal electronics
P	Programmable, additional functions
	Cable outlet
G	Axial
	Module
3	Scanning of target wheels with module M = 0.3
5	Scanning of target wheels with module M = 0.5
	Connection 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 cable for temperature sensor
2444	- - - - -

⁽¹⁾ (state cable length in cm)

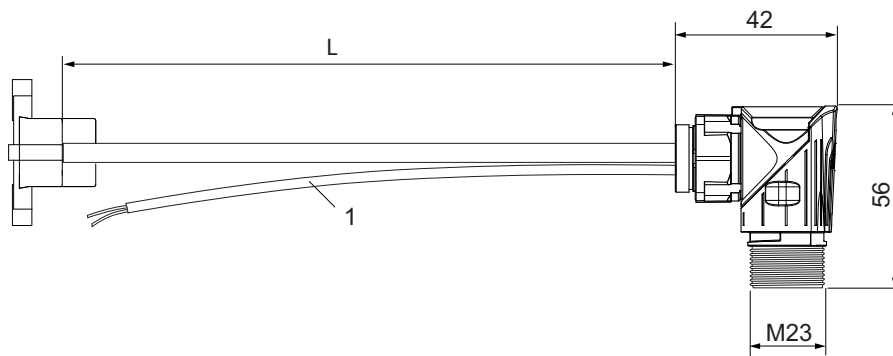
Dimensional drawings connection types



Connection type **K** – flying lead



Connection type **N** 17-pin panel-mounting socket, straight



Connection type **M** 17-pin panel-mounting socket, angled







Key

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

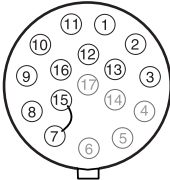








Connection

Pin layout

Connection type K

Flying lead	Core colour	Signal/ function		
	white	SIN+	Signal track 1	
	brown	SIN-	Inverse signal track 1	
	grey	REF+	Signal reference track N	
	blue	0 V	GND	
	red	U_B	+ 5 V supply	
	pink	COS+	Signal track 2	
	black	COS-	Inverse signal track 2	
	yellow	REF-	Inverse signal reference track N	
	green	U_{Sense}	5 V Sense	

Connection type N and M

17-pin panel-mounting socket	Core colour	Pin	Signal / function			
	white	1	SIN+	Signal track 1		
	brown	2	SIN-	Inverse signal track 1		
	grey	3	REF+	Reference track		
		4 – 6	Not used			
	blue	7	0 V	GND		
	(brown) ⁽¹⁾	8	ϑ+	Temperature +		
	(blue) ⁽¹⁾	9	ϑ-	Temperature -		
	red	10	U _B	+ 5 V supply		
	pink	11	COS+	Signal track 2		
	black	12	COS-	Inverse signal track 2		
	yellow	13	REF-	Inverse signal reference track		
		14	Not used			
	-	15	0 V	GND	Jumper pin 7	
	green	16	U _{Sense}	5 V Sense		
		17	Not used			

⁽¹⁾ Option: Temperature sensor cable

Explanations about the target wheel

Target wheels

For detecting rotary movements, the MiniCODERs and target wheels form a complete unit. The target wheel size and hence, its diameter are directly dependent on the module and the number of teeth.

Standard target wheels

Standard target wheels are available at short notice ex factory. Specifications and designs see "Technical information ZA_x / ZF_x".

Customised target wheels

On request, customised target wheels are manufactured according to individual specifications. Please send us a dimensional drawing of your target wheel (if possible, as a dxf-file) to info@lenord.de.

Module

The module is a tooth parameter for tooth wheels and describes the relationship between the number of teeth and the pitch circle diameter of the tooth wheel. For the majority of applications the outside diameter of the target wheel is crucial. Given the same number of teeth, the smaller the module the smaller outside diameter.



The MiniCODER must be ordered to suit the module of the target wheel.

Reference marks

The MiniCODER can detect reference marks in the form of a slot, lug or tooth. The pulse detected can be used for referencing the position. This feature is necessary, for example, to automatically change a tool in a milling spindle or grinding spindle.

The selection of the reference mark is defined by the size 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 mark N – lug

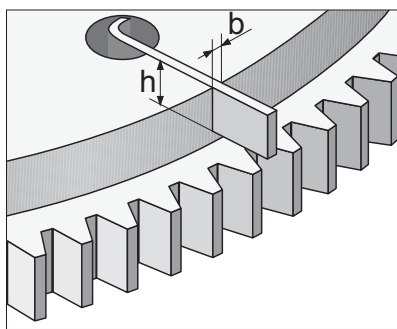
A metal lug integrated into the target wheel and that is positioned exactly between two teeth is detected. The lug must be made of ferromagnetic material and must not protrude beyond the outside diameter of the target wheel. Due to the forces acting on the reference lug, this variant is only allowed to be used in a very limited speed range.

Reference mark M – slot

At rotational speeds above 30,000 min⁻¹ a target wheel with reference slot can be used. The MiniCODER detects the reference slot between two teeth. This target wheel is made up of two pieces for technical reasons.

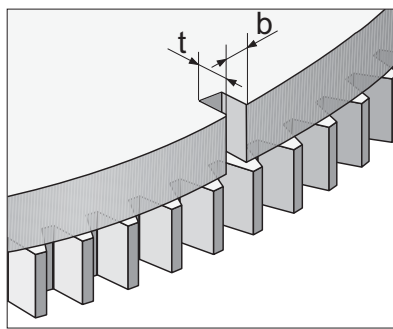
Reference mark Z – tooth on tooth

These target wheels are made from one piece. On one side the teeth are milled away except for one tooth. In this way a reference track is produced with one tooth that is detected. Rotational speeds above 100,000 min⁻¹ are allowed.



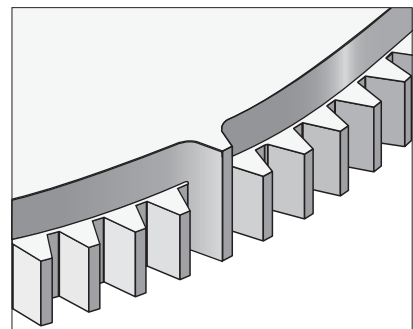
N = Reference mark – lug

$h = 4 \text{ mm}$
 $b = 0.5 \text{ mm}$



M = Reference mark – slot

$t = 1 \text{ mm}$,
 $b = 1.2 \text{ mm}$ for module 0.3
 $b = 1.6 \text{ mm}$ for module 0.5



Z = Reference mark – tooth

Testing and programming unit



- ▶ Testing any sensors with sin/cos output 1 V_{PP} and reference signal, e.g. MiniCODER
- ▶ Transmitting the data via WLAN to mobile terminals (tablet, PC etc.)
- ▶ Display of the data in a web browser, independent of the operating system

- ▶ Used for checking the signals for compliance with adjustable tolerance limits
 - sin/cos signals (amplitude, offset, phase offset)
 - Reference signal (amplitude, offset, position and width)
 - Target wheel (damage, concentricity, quality of the teeth)
- ▶ Defining and saving different tolerance limits

- ▶ **MiniCODER plus:** usage for setting the parameters
 - Automatic calibration of the sin/cos signals
 - Configuring/reading the operating hours counter
 - Saving the 7 configured speed ranges of the operating hours counter in one recordPossible to save several records in the GEL 211

For more detailed information on the testing and programming unit see separate technical information "TI GEL 211"



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The latest version can be downloaded at www.lenord.com.

