MiniCoder
GEL 2444T
Sensor with square-wave signals and internal interpolation

Technical Information ***Version 11.12***

General

- The measuring unit consists of a sensor and a precision target wheel for mounting on shafts with diameters ranging from 8 mm to more than 500 mm.
- Measurement of speed and position by proximity sensing of precision target wheel with magnetoresistive sensor elements.
- Output signals are two 90° shifted square-wave signals and their inverse signals (TTL / RS 422). Optionally with a reference pulse.
- Sensor signals internally amplified and temperature compensated

Features

- Output signal level TTL / RS 422
- Frequency range from 0 to 200 kHz
- Speed measuring range from 0 to more than 100.000 min^{-1}
- Temperature range -40 to +120°C
- Protection class IP 68

Advantages

- Extreme robust, fully encapsulated sensor
- Highly resistant to interference due to metallic housing
- Sufficient scope for construction due to customerspecific production of precision target wheels
- Wear and maintenance-free

Fields of application

- Machine tool engineering
  - Position and speed measurement of the main spindle in lathes, grinding and milling machines
  - Speed and position measuring in HSC spindles (High Speed Cutting)
  - Electronic synchronization of helical spindles in dry-running vaccum pumps
- Angle measurement in radar equipment
- Measurement of speed and position in test stands

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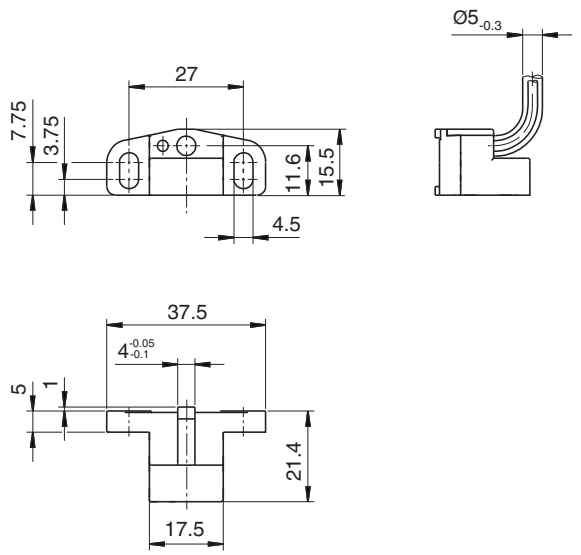
Technical Data

Electrical Data	
Supply voltage V_S	5 V DC ± 5%, reverse polarity protected
Output level	TTL / RS422
Output signal	two 90° phase-shifted square-wave signals and inverse signals, short-circuit proof; optionally with reference pulse
Output frequency	0 to 200 kHz at a line capacity of 5 nF
Power consumption without load	≤ 0.3 W
Electromagnetic compatibility	EN 61000–6–1 to 4 (1)
Insulation stability	500 V, according to EN 60439–1
Mechanical Data	
Admissible air gap	0.15 mm ± 0.02 mm with module 0.3 (diametric pitch 81.3) 0.2 mm ± 0.03 mm with module 0.5 (diametric pitch 50.8)
Width of the target wheel	min. 4.0 mm
Material of the target wheel	Ferromagnetic steel
Max. admissible cable length	100 m (note the voltage drop on the power line)
Working temperature	–30 °C to +85 °C
Operating and storage temperature	–40 °C to +120 °C
Protection class	IP 68
Vibration resistance	200 m/s^2, according to EN 60068–2–6
Shock resistance	2000 m/s^2, according to EN 600068–2–27
Weight	30 g
Housing	Zinc diecasting and PPS (cable cover)
Connection	Nine-core cable, wire cross section 0.15 mm^2, O.D. 5$_{-0.3}$ mm, min. bending radius 25 mm. Separate screen connection line for near-sensor earthing (e.g. using one fixing screw)

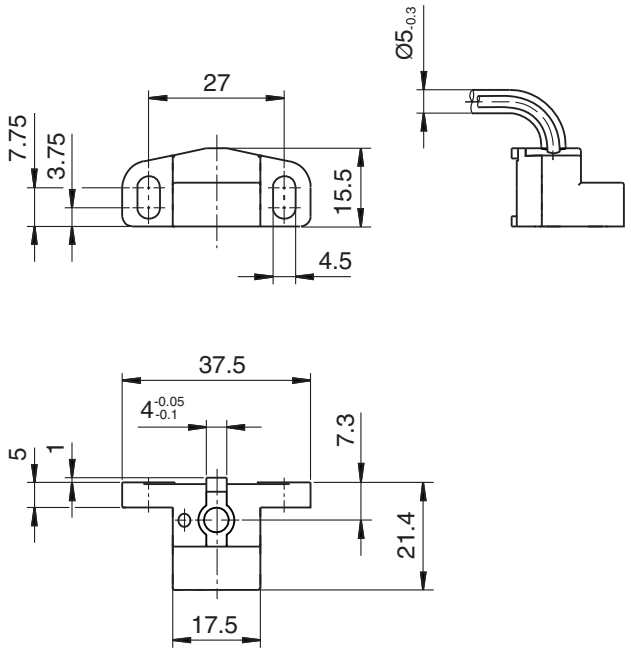
(1) The normative limit values are met if mounting and connection jobs are carried out properly. Coaxial earthing of the MiniCoder connection cable (e.g. on the free cable end) and keeping the separate screen connection line as short as possible will additionally improve noise immunity.

Dimensional drawing

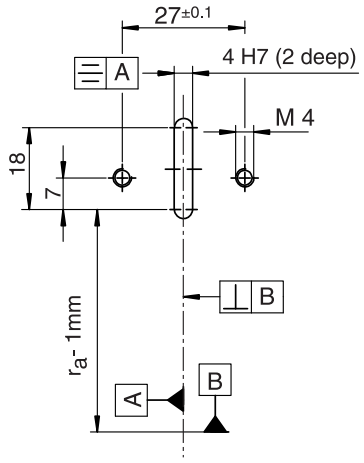
GEL 2444T axial cable outlet



GEL 2444T radial cable outlet



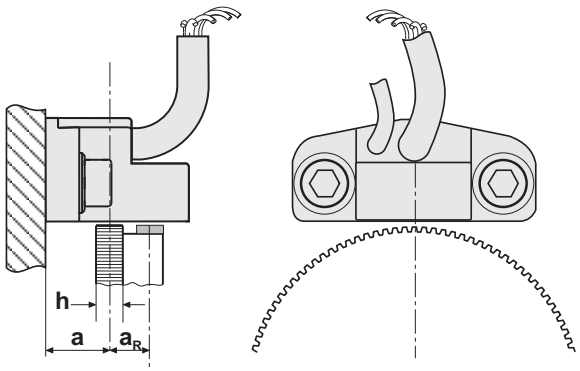
Drilling and milling plan



All dimensions in mm

r_a = $d_a/2$
(with d_a = outer diameter of target wheel)

Assembly drawing



a Distance (9.5 ±0.5 mm)
a_R Distance to reference mark (6 mm)
h Width of target wheel (> 4.0 mm)

Type code,
Target wheels

Type code GEL 2444T

	Signal pattern							
	T Square-wave signals TTL / RS422							
		Reference mark						
		– None						
		N Flag						
		M Groove						
		Z Flag aligned with tooth (recommended)						
			Interpolation factor					
			1 1					
			2 2					
			4 4					
			8 8					
			A 10					
			B 12					
			C 16					
			D 20					
				Cable outlet				
				R Radial				
				G Axial				
					Module			
					3 0.3			
					5 0.5			
						Connection type		
						K Open cable end		
							Cable length	
							Specification in cm: 030, 150, 250, or 600	
								Separate screen connector cable on the probe
								E Mandatory
2444	_	_	_	_	_	_	_ _ _	_

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

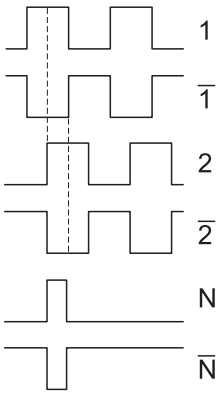
Standard target wheels are available at short notice ex factory. Specifications and designs see “Technical information ZAx / ZFx”.

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**.

Signal pattern

T = square-wave signal



* Reference signal with option reference mark only

Signal pattern	V_S	V_{out}
T- TN TM TZ	+ 5 V DC ± 5%	TTL

V_S Supply voltage
V_{out} Signal output

Reference marks

Reference marks may occur in the form of a groove or a flag. The flag must be made of ferromagnetic material and may not protrude beyond the gear-wheel of the target wheel. The selection of the reference mark is determined by the size and speed of the used target wheel, as both variables affect the forces acting on the reference mark.
For new designs, we recommend the use of target wheels with reference mark variant "**Z**".

Reference mark N – Flag

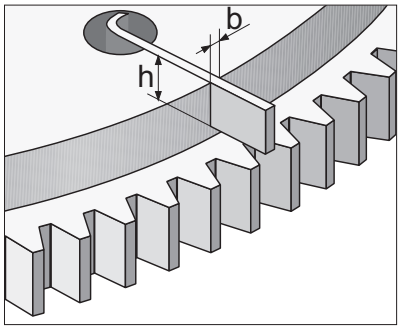
A metal flag integrated in the target wheel is detected when its position is exactly between two teeth. This reference signal can be used as a positon reference. This is required, for instance, for the automatic changing of a tool in a milling or grinding spindle.

Reference mark M – Groove

Depending on size and geometry of the target wheel, the target wheel version with a reference flag can only be used up to certain speeds. For speeds beyond 30.000 min^{-1}, a MiniCoder detecting a reference groove integrated in the target wheel is used. For technical reasons, the target wheel is in this case composed of two parts.

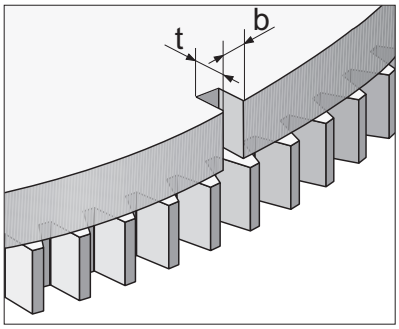
Reference mark Z – flag aligned with tooth

This MiniCoder version can be used for scanning a target wheel manufactured in one piece. The system permits reaching speeds of more than 100.000 min^{-1}.
The reference flag sits precisely on one tooth of the pulse track.



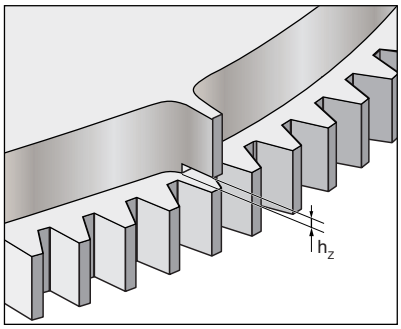
***N** = reference mark – flag*

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



***Z** = reference mark – flag aligned with tooth*

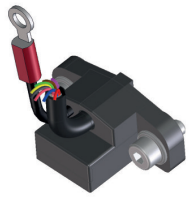
h_Z = 2 mm

Explanations of the type code

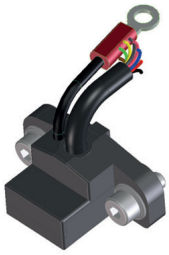
Interpolation factor

The new electronic module used in the GEL 2444T MiniCoder enables the generated sin/cos signals to be interpolated directly.
This means, for instance, that for a precision target wheel with 250 teeth, you have 5000 square wave pulses per revolution available (this is with factor D = 20). Higher factors are available on request.
This interpolation is carried out directly within the sensor. By using four-edge evaluation in the control electronic a resolution of up to 20,000 steps per revolution is possible.

Cable outlet



***G** = Axial cable outlet*



***R** = Radial cable outlet*

Module

The module describes the relation between the number of teeth and the outer diameter of a target wheel. The smaller the module the smaller the outer diameter for the same number of teeth.
The air gap to be observed between sensor and target wheel is less with module 0.3 than with module 0.5.

Type	Module	Air gap *d*, adjusting characteristic	Distance tolerance
3	0.3	0.15 mm	± 0.02 mm
5	0.5	0.20 mm	± 0.03 mm

The MiniCoder must be odered to match with the target wheel.

Cable length

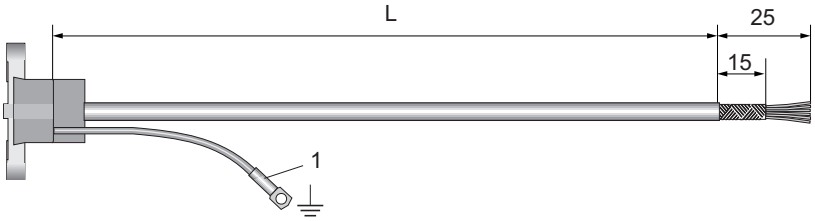
For connection type K (open cable end), 4 cable length are available: 30, 150, 250, 600 cm. For cable assembling with plug connectors, the cable length must given in cm.
Cable type PUR cable, screened, 9 x 0.15 mm^2
Outside diameter: 5 mm (- 0.3)
Min. bending radius: 25 mm

Screen connection on sensor

This screen connection is connected to the screen of the sensor cable. In order to improve electromagnetic compatibility (EMC), the screen connection should be connected to the flange on which the MiniCoder is mounted.

Connection type

Type **K**: the MiniCoder is manufactured with open cable end.



*Connection type **K** – open cable end*

1 Screen connection associated with cable screen.*)

L Cable length (see type code)

*) Note: Fit the cable screening as coaxially to the earth cable as possible. When fitting the cable screening onto an earth cable, the earth cable should be run as short as possible.

Connection assignment

Lead colour	Signal/ function		T-	TN, TM, TZ
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 voltage		
pink	V_{2+}	Track 2		
black	V_{2-}	/Track 2		
yellow	V_{N-}	/Reference track		
green	V_{Sense}	5 V sense		

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