

Speed and position sensor

MiniCoder GEL 2444

contactless, high-resolution,
high speed, metal casing

SENSORLINE

LENORD+BAUER

Technical information

version 06.09



Main features

- Metal casing
- Square-wave output
- Internal interpolations factor configurable ex works

Functional description

- Measurement of speed and position by proximity sensing of precision target wheel
- Scanning by means of magnetoresistive sensor elements
- Measuring unit consisting of sensor and precision target wheel for installation on shafts with diameters ranging from 8 mm to more than 500 mm

Applications

- Speed detection in HSC spindles (High-Speed-Cutting)
- Measurement of speed and position of milling and grinding spindles in machine tools for the machining of metal, wood, glass, stone and aluminium
- Angle measurement in radar equipment
- Electronic synchronization of helical spindles in dry-running vacuum pumps
- Measurement of speed in test stands

Special features

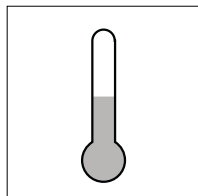
- Sufficient scope for construction due to customer-specific production of precision target wheels
- Internal production of target wheels with module 0.3 and 0.5 from speeds from 0 to more than 70,000 min⁻¹
- Cable outlet axial or radial
- Sensor fully encapsulated
- Very compact

Measuring principle

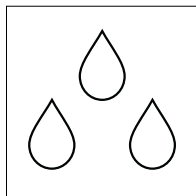
- Integrated MR-sensors for contactless scanning of target wheel
- Sensor signals internally amplified and temperature-compensated
- Frequency range from zero to max. 200 kHz

Output signals

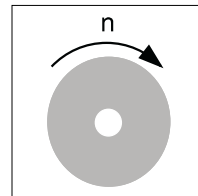
- Outputs short-circuit-proof
- Signal forms:
 - two square-wave signals offset by 90° and the corresponding inverse signals TTL / RS 422
 - option: reference pulse



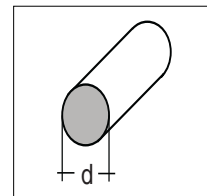
-40 ... +120°C



IP 68



$n = 0 \dots > 70.000 \text{ min}^{-1}$



$D = 22 \dots > 500 \text{ mm}$
 $d \geq 8 \text{ mm}$

Technical data GEL 2444

Output level	TTL / RS 422
Output signals	two square-wave signals, by 90° out of phase, and their inverse signals short-circuit-proof, option: reference pulse
Output frequency	0 to 200 kHz for $C_L = 5 \text{ nF}$
Supply voltage V_s	5 V DC $\pm 5\%$
Power consumption without load	$\leq 0.3 \text{ W}$
Permissible air gap	0.15 mm $\pm 0.02 \text{ mm}$ with module 0.3 0.20 mm $\pm 0.03 \text{ mm}$ with module 0.5
Width of target wheel	min 4.0 mm
Material of target wheel	ferromagnetic steel
Operating temperature range	-30 °C to +85 °C
Ambient and storage temperature range	-40 °C to +120 °C
Protection class	IP 68
Electromagnetic compatibility	EN 61000-6-1 to 4*
Insulation strength according to EN 60439-1	500 V
Vibration resistance (IEC 68-2-6)	200 m/s ²
Shock resistance (IEC 68-T2-27)	2000 m/s ²
Weight	30 g
Housing material	zinc diecasting
Connection	9-core cable, cross section 0.15 mm ² , outside diameter 5 mm(-0.3), min. bending radius 25 mm

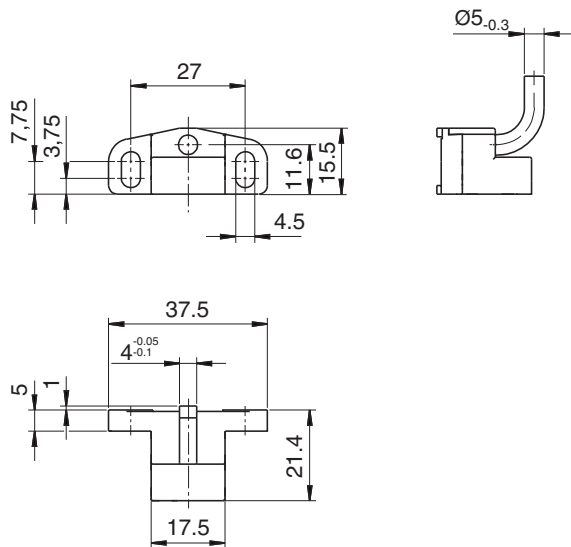
The technical data provided are valid for the operating temperature range.

*) Important: Where possible, connections to the cable screen should be made coaxially. Connections to the cable screen using single wire cores should be kept as short as possible.

Dimensional drawing, Boring and milling sketch

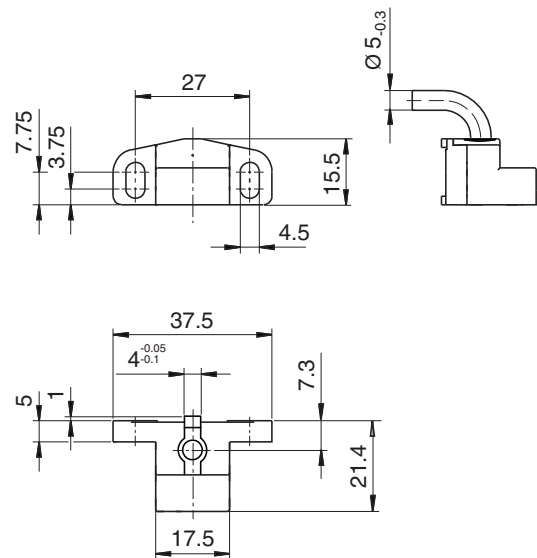
Dimensional drawing

Axial cable outlet

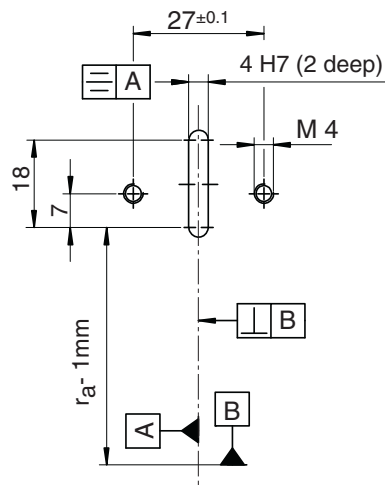


Dimensional drawing

Radial cable outlet



Boring and milling sketch

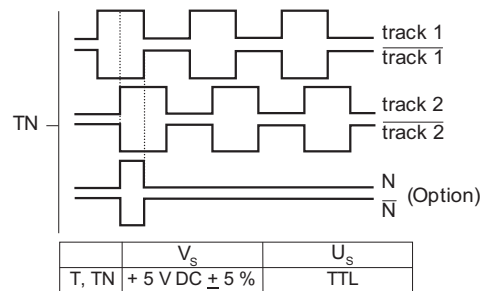


$$r_a = d_a/2; d_a = \text{OD of target wheel}$$

Typecode

Signal pattern									
T Square-wave signal									
Reference mark									
- without reference mark									
N flag (between teeth)									
M groove									
Z flag (congruent with teeth)									
Interpolation factor (higher factors upon request)									
1 1									
2 2									
4 4									
8 8									
A 10									
B 12									
C 16									
D 20									
Cable output									
R radial									
G axial									
Module									
3 0.3									
5 0.5									
Connection type									
K Cable end open									
Cable length (cm)									
Cable length 030, 150, 250 and 600 cm									
Additional screen connection on sensor head									
2444	-	-	-	-	-	-	-	-	-

T = Square-wave signal



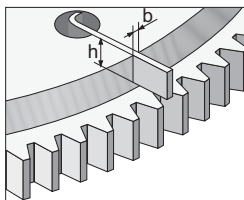
N = reference mark (tab)

M = reference mark (groove)

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

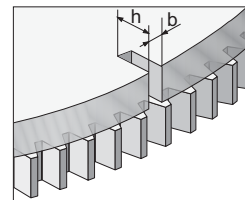
Depending on size and geometry of the target wheel, the target wheel version with a reference tab can only be used up to certain speeds. For speeds beyond 30.000 min⁻¹, a MiniCoder detecting a reference groove integrated in the target wheel is used. For technical reasons, the target wheel is in this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

h = 4 mm
b = 0.5 mm



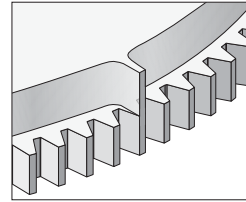
h = 1 mm

Module	b
0.3	1.2 mm
0.5	1.6 mm



Z = Reference mark (tab over groove)

This MiniCoder version can be used for scanning a target wheel manufactured in one piece. The system permits reaching speeds of more than 70.000 min⁻¹. The reference tab is in alignment with a tooth of the pulse track.



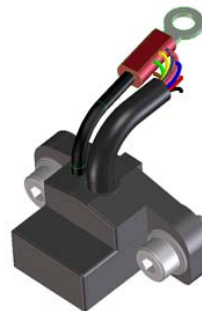
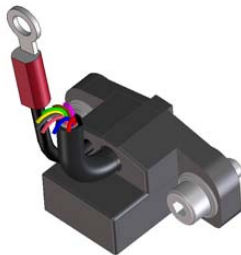
_ = Internal multiplier

Durch Einsatz eines neuen elektronischen Bausteins können die im Minicoder GEL 2444 erzeugten Sin/cos-Signale direkt interpoliert werden. So stehen dem Anwender z. B. bei Einsatz eines Präzisions-messzahnrades mit 250 Zähnen, 5000 Rechtecksignale zur Verfügung (gewählter Faktor D = 20).

(höhere Faktoren auf Anfrage)
Die Interpolation erfolgt direkt im Sensor. Zusätzlich kann die Auflösung über die 4-Flankenauswertung in der Steuerelektronik im vorgenannten Beispiel auf 20.000 Schritte erhöht werden.

G = Axial cable outlet

R = Radial cable outlet



3 = Module 0.3

5 = Module 0.5

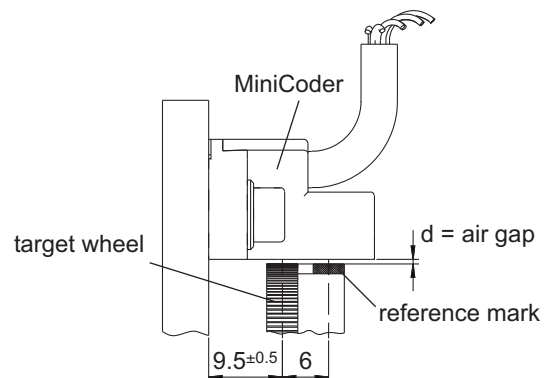
The module describes the relation between the number of teeth and the outer diameter of a target wheel. The smaller the module the smaller the outer diameter for the same number of teeth.

The air gap to be observed between sensor and target wheel is less with module 0.3 than with module 0.5.

$$d_a = m \cdot (z+2)$$

d_a = outer diameter
 m = module
 z = number of teeth

The MiniCoder must be ordered compatible with the target wheel.

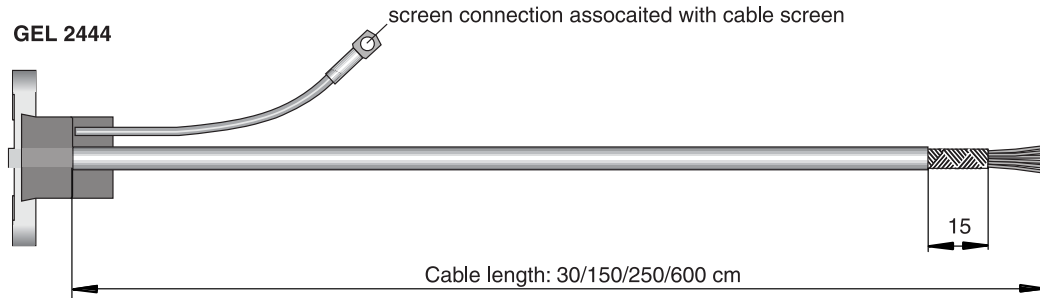


module	air gap d adjustment dimension	distance tolerance
0.3	0.15	± 0.02 mm
0.5	0.20	± 0.03 mm

Type code

Connection type K = cable end open

The MiniCODER are manufactured with open cable end. The following cable length are available (30/150/250/600 cm).



Important: 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.

Colour	Function	T	TN
white	track 1		
brown	track 1		
grey	N		
blue	0 V GND		
red	$V_S = 5 \text{ V DC}$		
pink	track 2		
black	track 2		
yellow	$\bar{N}$		
green	5 sense		

___ = Cable length (cm)

For connection type K= cable end open, 4 cable length are available:-30, 150, 250, 600 cm. For ready-made connecting cables with male connectors, the length of the cable is to specified in cm.

Cable type: PUR cable 9 x 0.15 mm² screened
Screen not connected on MiniCoder side
Outside diameter: 5 mm (– 0.3)
Min. bending radius: 25 mm

E=- Additional screen connection on sensor head.

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.

Custom-made target wheels

Standard target wheels

Custom-made target wheel

Target wheel are made to individual specifications on request of the customer. Please send us a dimensional drawing of your target wheel (if possible, as a dxf-file) the inquiry form on page a 11 to info@lenord.de.

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, i.e.:

$$z = (d_a / m) - 2$$

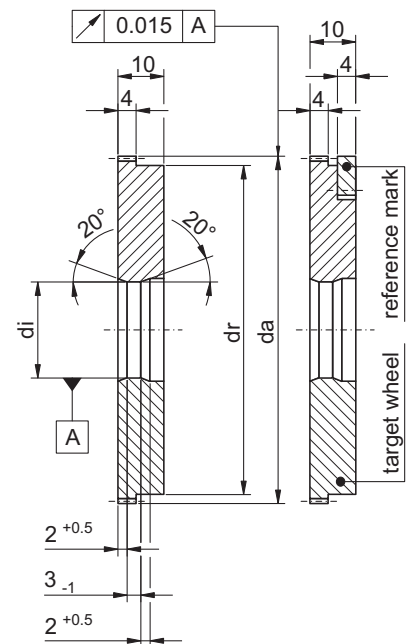
$$d_a = m \cdot (z+2)$$

Standard target wheels (see table) are available at short noticeex factory.

Table standard target wheels

number of teeth z	module m [mm]	OD-Ø da [mm]	ID-Ø standard [mm]	ID-Ø di max. [mm]	collar-Ø dr [mm]
100	0.5	51.0	12 H7	30 H7	47
125	0.5	63.5	12 H7	35 H7	60
128	0.5	65.0	12 H7	35 H7	61
200	0.5	101.0	12 H7	70 H7	97
250	0.3	75.6	12 H7	45 H7	72
250	0.5	126.0	25 H7	85 H7	122
256	0.3	77.4	12 H7	50 H7	74
256	0.5	129.0	25 H7	90 H7	125
360	0.3	108.6	25 H7	70 H7	105
500	0.3	150.6	25 H7	110 H7	147
512	0.3	154.2	25 H7	110 H7	151

Dimensional drawing target wheel



Type code for standard target wheels

	N -	reference mark			
		with reference mark			
		without reference mark			
		3 5	module		
			module 0.3		
	5	module 0.5			
		0100	number of teeth		
			e. g. (see chart at the top)		
		012.0	inside diameter		
			e. g. (see table above)		
ZA	-	-	- - - - -	- - - - -	

Fax: +49 (0)208 676292

Transmitter

Name:	Contact/person in charge:
Street:	
Postal code/City:	
Phone:	Phone:
Fax:	Fax:

Target wheel

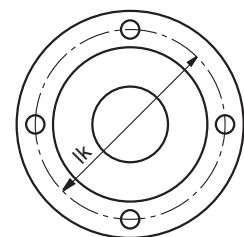
Form of target wheel ☐ A ☐ B ☐ C	Width of target zb (≥ 4 mm)	mm
☐ AN	$\emptyset$ right dr	mm
☐ BN	($\leq da - 29$ mm with zero flag)	
☐ CN	$\emptyset$ left dl	mm
Tooth number z	Collar right br	mm
Module m ☐ 0.3 ☐ 0.5	Collar left bl	mm
$\emptyset$ OD da = $m(z+2)$	Reference mark (flag) ☐ yes ☐ no	
$\emptyset$ ID di + Tolerance field	Referenc mark (groove) ☐ yes ☐ no	
$\emptyset$ Shaft dw + Tolerance field	Revolution n_max	min ⁻¹
	Purchase quantity	pieces

Hole circle/bores for mounting

☐ Thread bore ☐ Through bore ☐ Cylindrical counterbore ☐ Conical counterbore

$\emptyset$ Hole circle	lk	mm
$\emptyset$ Bore/thread	b	mm
$\emptyset$ Bore	b₁	mm
Depth	t	mm
Number of bores		

Hole circle lk



Additional remarks

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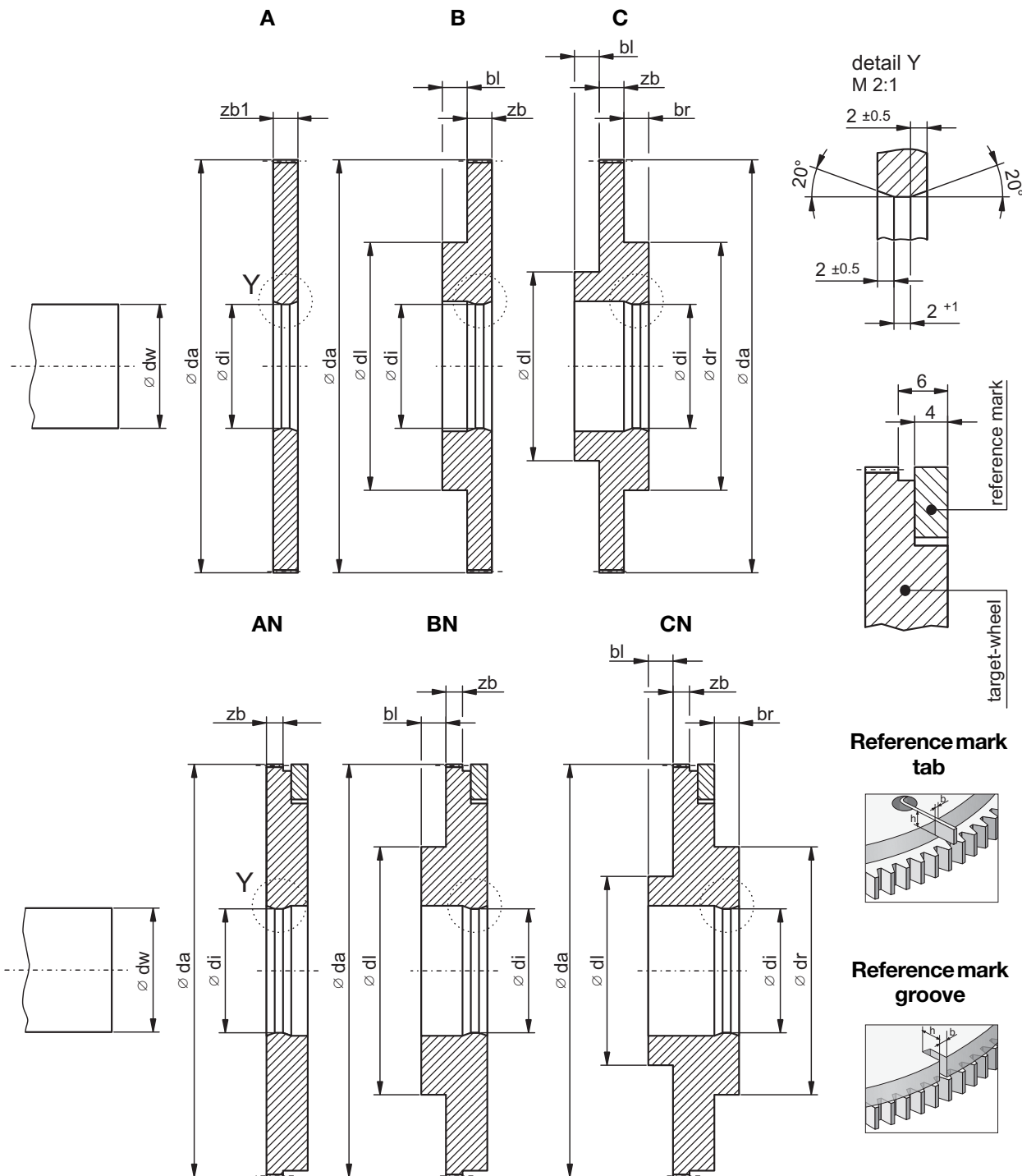
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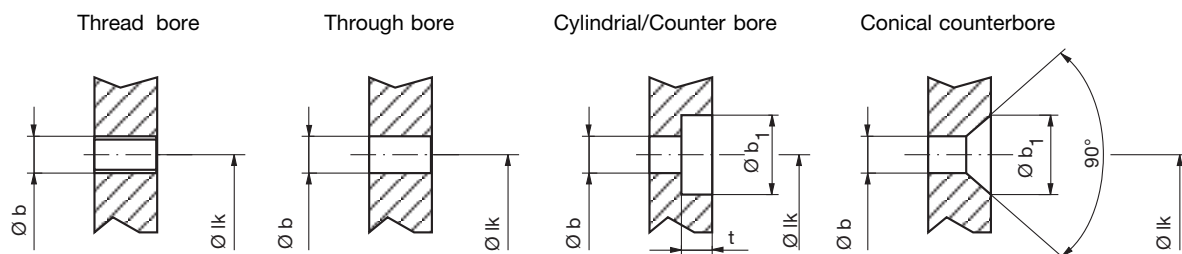
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Target wheels



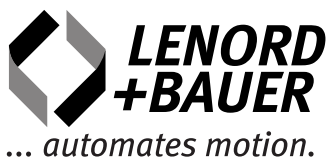
Bores for mounting



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Subject to technical modifications and typographical errors.
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