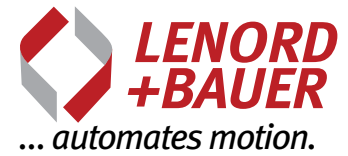


Magnetic incremental rotary encoder

▶ GEL 295x

Customer-specific precision encoder



Technical Information

Version 2014-12



General information

- ▶ Extremely robust rotary encoder with stainless steel housing for measuring rotational movements of machines and vehicles
- ▶ Contactless magnetic scanning of an integrated target wheel
- ▶ Rotary encoder with solid shaft (shaft diameter 16 mm) or with integrated hollow shaft coupling (diameter 20 mm)
- ▶ Plug or cable outlet with customer-specific modifications available
- ▶ Up to 5 sensors in one housing, three different signal patterns available

Features

- ▶ High electromagnetic compatibility and interference immunity
- ▶ High temperature range -40 °C to +120 °C
- ▶ Protection class IP 67
- ▶ Voltage or current output
- ▶ Vibration resistance up to 20 g

Advantages

- ▶ Solution individually tailored to the specific application, as up to 5 sensors can be integrated in one housing
- ▶ Maintenance-free, durable operation in the harshest ambient conditions due to selected bearings and a magnetic measuring system
- ▶ Highly resistant to condensation, spray, condensed water and aggressive chemical substances

Field of application

- ▶ Rail vehicle industry
 - Traction monitoring
 - Electronic anti-skid protection
 - Motor rotational speed
 - Anti-slip protection
- ▶ Machinery and motors
- ▶ Heavy industry
- ▶ Metallurgy
- ▶ Composting plants
- ▶ Sewage treatment plants

Description

Concept

The precision encoders GEL 295x are designed as an modular, application-specific encoder system and consist of a housing component and modular sensor systems. All rotary encoders GEL 295x are manufactured to drawing or application description. The technical specifications may vary from the technical data given. The modified specifications and the pin layout are to be found on the customer-specific dimensional drawing.

Construction and design

The series GEL 295x rotary encoders are extremely robust sensors for the measurement of rotary movements or positions on machines and vehicles. Due to their high resistance to condensation, spray and condensed water, as well as the very wide temperature range from $-40\text{ }^{\circ}\text{C}$ to $+120\text{ }^{\circ}\text{C}$, they are particularly suitable for use in rail vehicles or in heavy industry.

The housing component is available with solid shaft or hollow shaft including an integrated flexible precision hollow shaft coupling. The resilient encoder housing with a standard flange size of 115 mm is made of stainless steel. The electrical connection of the sensor system is variable, using plug connectors or cable outlets.

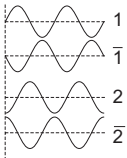
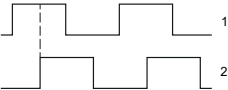
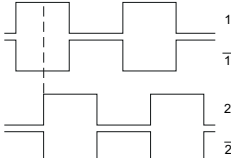
A very large number of customer-specific requirements can be met using the modular sensor system.

The GEL 295x offers particular advantages especially in relation to redundancy and safeguarding against failures. The rotary encoder comprises up to five separate sensors. A Y number is assigned to customer-specific designs, this letter is appended to the product identifier (GEL 295xYxxx).

Notes on mounting

The flexible high-precision hollow shaft coupling compensates eccentricities, axial impacts and vibrations. The precision encoders are designed to be mounted on an expansion shaft with a diameter of 20 g7 mm. The expansion shaft must contain an inside thread, e.g. M12, to accept a hexagon socket set screw, and must not project more than 15 mm into the hollow shaft coupling. The set screw is screwed in, with its hexagon socket first, into the direction of the expansion shaft. A centring flange ensures the exact positioning of the high-resolution encoder in the mounting device.

Available signal pattern

<p>K Two sine-wave signals, phase-shifted by 90°, with inverse signals</p> 	<p>V Two square-wave signals, phase-shifted by 90°</p> 	<p>X Two square-wave signals, phase-shifted by 90°, with inverse signals</p> 
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The rotary encoder with solid shaft must be connected with the drive shaft via a flexible coupling. The flexible clamp coupling type KK 14 is recommended. The degree of axial offset between the shaft ends directly influences the degree of the phase displacement. In particular, this must be taken into account for systems with high pulse numbers.

Sensing principle

The rotary encoders work with differential, magnetic-field-dependent sensors and a precision target wheel. The sensors scan without contact the tooth structure of the target wheel and output a sine and cosine voltage. The integrated evaluation electronics converts the analog sensor signals into incremental output signals.

By interpolation of the integrated evaluation electronics, the sinusoidal signals can be converted into rectangular output signals.

In the basic version, signal pattern K, V and X are available (see table). On request we check the feasibility of other signal patterns.

Possible pulse numbers

The possible pulse numbers depend on the signal output. The version with sine/cosine differential signal provides 256 pulses per revolution, signal pattern is K (smaller pulse numbers on request).

For signal pattern V and X, 150 or 256 pulses are supplied and interpolated. Hence the following pulses are available:

Pulse numbers for signal pattern V and X

Input pulses	Interpolation factor						
	1	2	3	4	5	6	8
150	150	300	450	600	750	900	1200
256	256	512	768	1024	1280	1536	2048

Output signal level

With signal pattern K 1 V_{PP} differential signals are output. The signal pattern V and X have HTL level (output voltage see "Technical data").

Technical data

Signal pattern	K	V	X
General data			
Resolution	256 sin/cos Periods ⁽¹⁾	150 to 2048 ⁽²⁾ pulses per revolution	
Precision short-wave (transformer and tooth forming error)	360° × 0.006 / pulse number		
Precision long-wave (radial run-out)	± 0.015°		
Electrical data			
Supply voltage V _S	5 V DC ± 5%	10 to 30 V DC	
Current consumption without load	≤ 1.0 W		
Output signals	Difference signal	Square wave signal ⁽²⁾	
Output signal level	1 V _{PP}	High: V _S - 1 V, Low: < 1.0 V ⁽³⁾	
Maximum permissible cable length	100 m (observe voltage drop on supply line)		
Mechanical data			
Housing material	stainless steel, X12CrMoS17-1,4104		
Weight	approx. 3 kg		
Admissible coupling offset axial lateral	± 1.3 mm ± 0.2 mm		
Speed range	0 to 6000 min ⁻¹		
Bearing life cycle	> 50 years (calculated value) Because of the limited grease operational life, the bearing should be replaced after a mileage of max. 1,200,000 km (rail vehicles) or every eight years.		
Ambient data			
Working temperature range (DIN 32876)	-40 °C to +85 °C		
Operating and storage temperature range (DIN 32876)	-40 °C to +120 °C		
Degree of protection (EN 60529)	IP 67 (hollow shaft side: corresponds to protection class of the engine or gear unit)		
Vibration resistance (EN 60068-2-6)	200 m/s ²		
Shock resistance (EN 60068-2-27)	2000 m/s ²		
Electromagnetic compatibility (EMC)	Industrial application: EN 61000-6-1 to 4 Rail vehicles: EN 50121-3-2		
Insulation strength (according to EN 60439-1)	500 V AC		

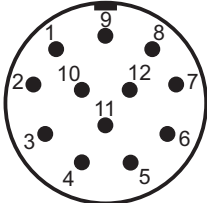
⁽¹⁾ smaller pulse numbers upon request

⁽²⁾ obtained by interpolation of the sinusoidal signals, interpolation factor 1, 2, 3, 4, 5, 6, 8

⁽³⁾ at 120 °C, 20 mA

Connection assignment

Connection assignment– mating connector

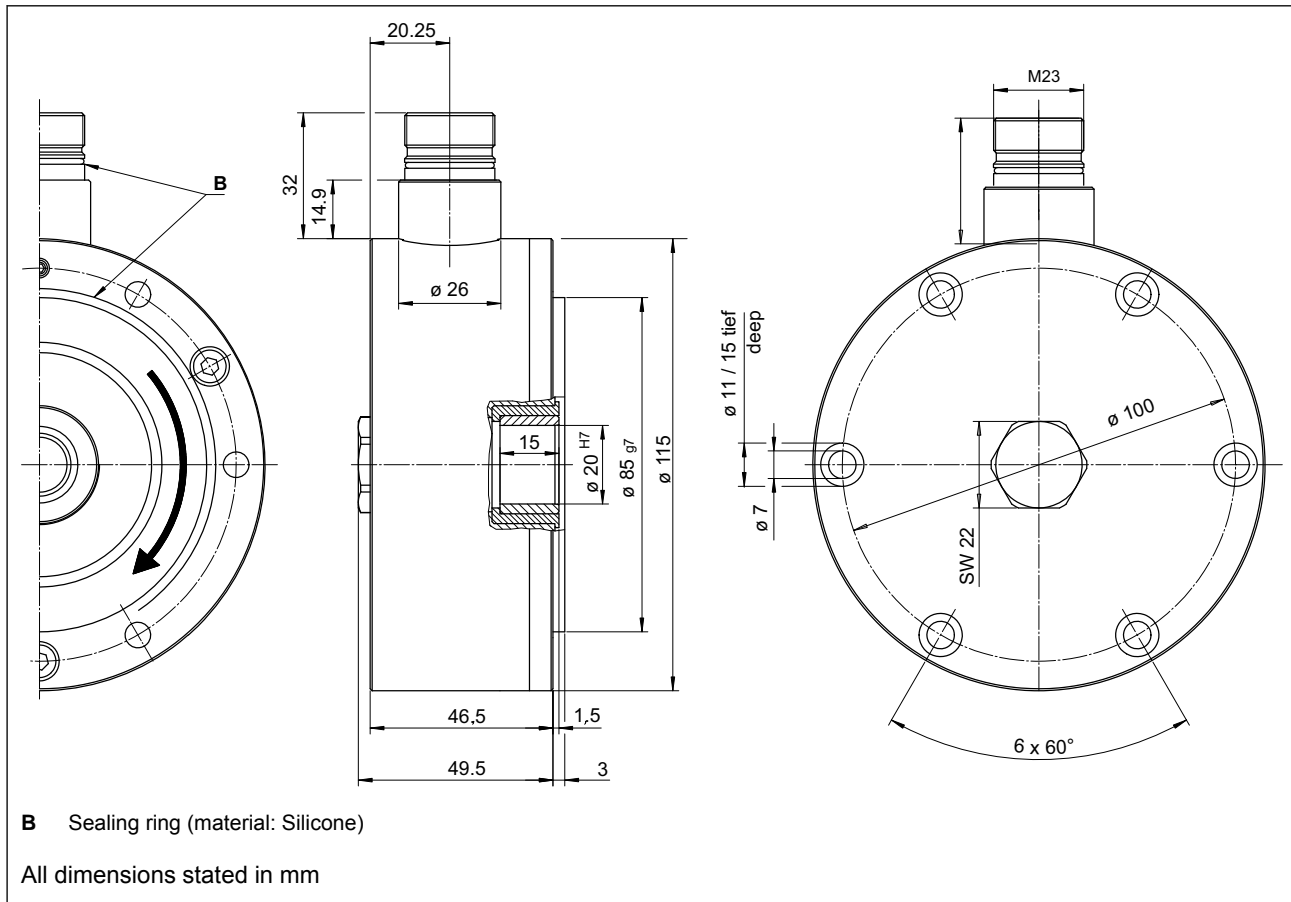
Pin layout	Pin	Signal pattern K	Signal pattern V, X	Function
 <p>Socket (= solder side of mating connector)</p>	1	/Track 2 ¹	/Track 2 ¹	Track 2, inverse
	2	—	—	not connected
	3	—	—	not connected
	4	—	—	not connected
	5	Track 1	Track 1	Track 1
	6	/Track 1	/Track 1	Track 1 inverse
	7	—	—	not connected
	8	Track 2	Track 2	Track 2
	9	—	—	not connected
	10	0V (GND)	0V (GND)	Ground
	11	—	—	not connected
	12	V _S 5 V DC	V _S 10 to 30 V	Supply voltage

Connection assignment – cable outlet

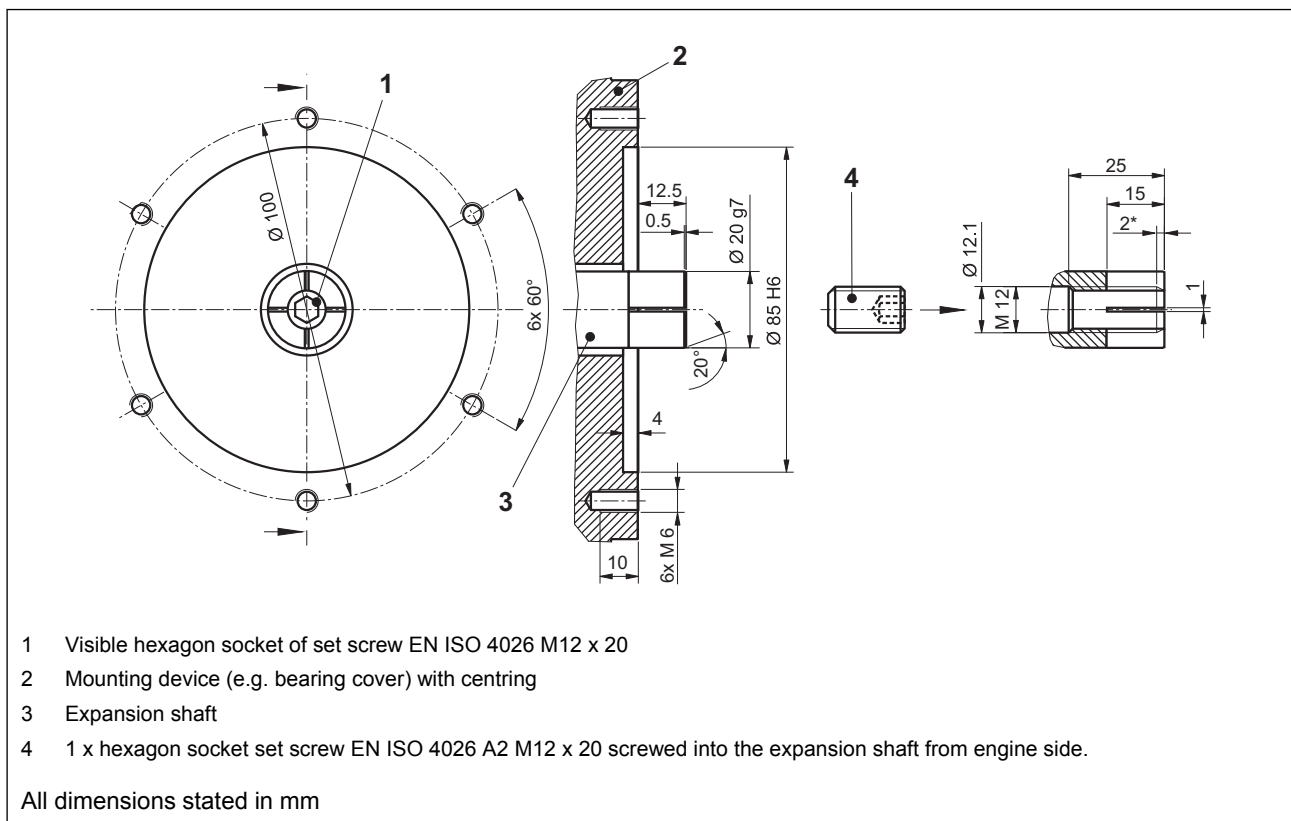
Core colour	Signal pattern K	Signal pattern V, X	Function
rot	V _S = 5 V DC	V _S = 10 to 30 V	Supply voltage
blau	0V (GND)	0V (GND)	Ground
gelb	U _{A+}	Track 1	Track 1
schwarz	U _{A-}	/Track 1	Track 1 inverse
weiß	U _{B+}	Track 2	Track 2
braun	U _{B-}	/Track 2 ¹	Track 2, inverse

Precision rotary encoder with hollow shaft

Dimensional drawing – housing component with one sensor system

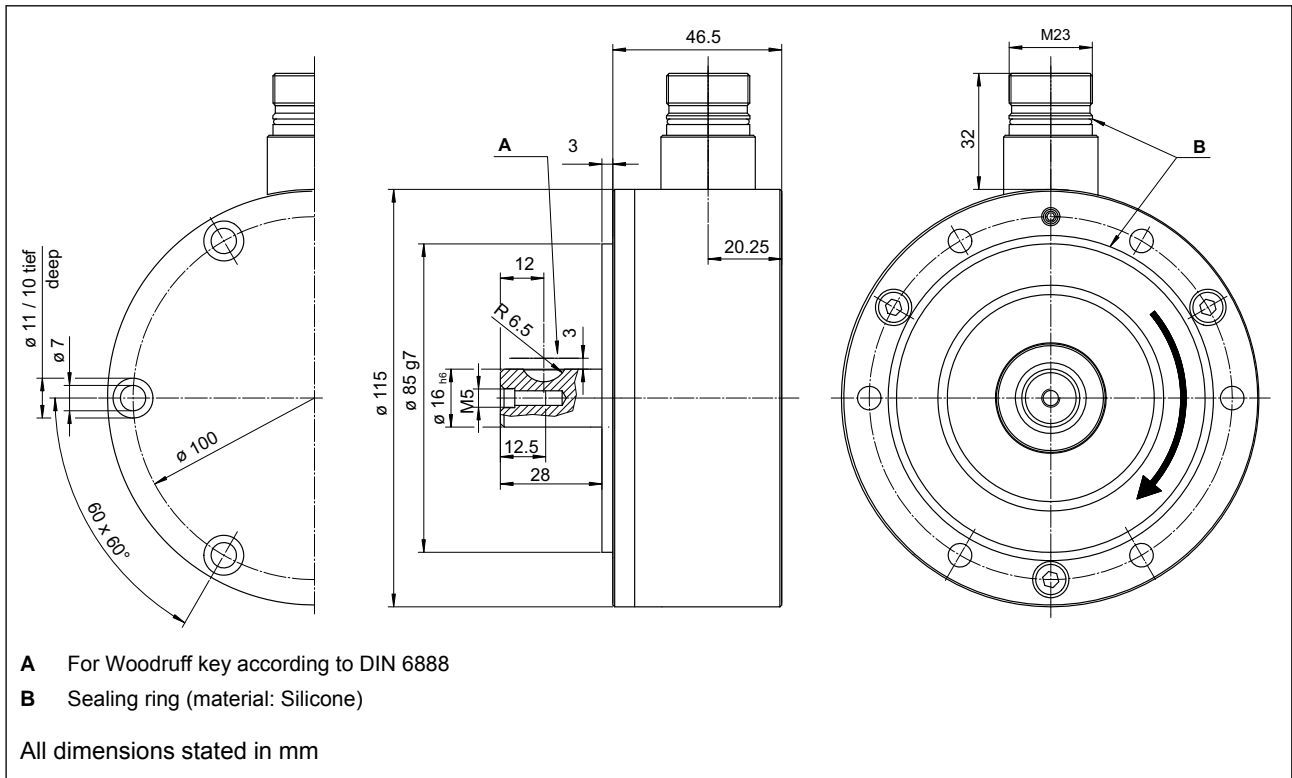


Assembly drawing and mating dimensions



Precision rotary encoder with solid shaft

Dimensional drawing – housing component with one sensor system

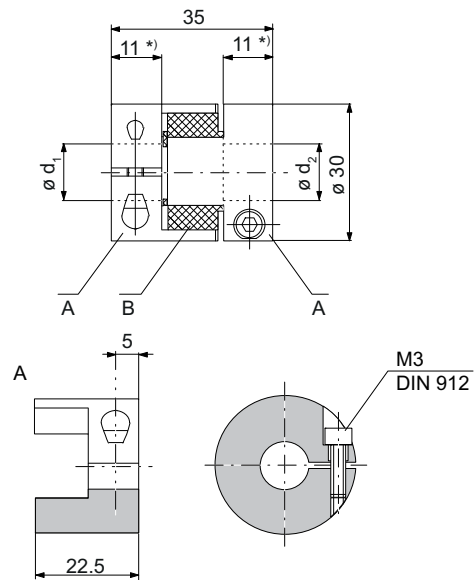


Dimensional drawing – Clamp coupling KK 14

2 identical coupling halves, positive-fit prestressed, backlash-free assembled

	$d_1^{(1)}$	$d_2^{(1)}$	Standard d_1 / d_2
KK 14	6 ... 16	6 ... 16	6/6; 8/8; 10/10; 12/12; 16/16
with different diameters d_1 and d_2 available			

static torsional stiffness 125 Ncm/°
 transmittable torque, backlash-free 100 Ncm
 maximum misalignment
 axial -1 mm
 radial 0.2 mm
 angular 1°



- *) Maximum dimension for inserted shaft
- A Coupling half
- B Involute gear rim

(1) tolerance H7

Type code and accessories

Type code

295x	Signal pattern	
	K	Two sine-wave signals phase-shifted by 90° with inverse signals
	V	Two square-wave signals phase-shifted by 90°
	X	Two square-wave signals phase-shifted by 90° with inverse signals
	Reference signal	
– without reference signal		
00000	Pulse number	
	00256 for signal pattern type K 00150 or 00256 for signal pattern type V and X the pulse numbers will be interpolated with the factors 1, 2, 3, 4, 5, 6, 8 ⁽¹⁾	
	Mating connector/cable outlet	
	D 12-pole connector plug, radial G 6-pole cable outlet, radial	
	Shaft design	
	0 20 mm with integrated hollow shaft coupling, insulated 2 16 mm with solid shaft	
	Special assembly	
	S Special version A Y number is appended to the product identifier, e.g. GEL 2952Yxxx (xxx = consecutive number), to mark the customer-specific design according to drawing or application description.	

Please contact our technical support team to specify the rotary encoder according to your requirements.

Accessories

Description	Item number
Clamp coupling KK 14, inner diameter: 6 to 16 mm (specify shaft diameter)	KK 14
Mating connector, M23, 12-pole, straight, IP 65	GG 126
Mating connector, M23, 12-pole, angled, IP 65	GW 126

⁽¹⁾ Example: 256 sin/cos periods with interpolation factor 4 → 1024 pulses per revolution



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