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Technical Information

GEL 295X

Magnetic incremental encoder

Customized precision encoders

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Finding solutions.
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Motion sensors and integrated drive technology

General

- Extremely robust rotary encoder with stainless steel housing for measuring rotational movements on machines and vehicles
- Contactless magnetic scanning of an integrated target wheel
- Rotary encoder with fixed shaft (diameter 16 mm) or with integrated hollow shaft coupling (diameter 20 mm)
- Connector and cable outlet with customized adaptations
- Up to 5 sensors with 3 different signal patterns in one housing



Properties

- High EMC resistance and interference immunity
- Wide operating temperature range from -40 °C to +120 °C
- Degree of protection 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
- Maintenance-free, durable operation in extremely harsh ambient conditions due to selected bearings and a magnetic measuring system
- High resistance to condensation, splash water, condensation and chemically aggressive substances

Field of application

- Rail vehicle industry
  - Traction monitoring
  - Electronic anti slip protection
  - Motor speed
  - Wheel slide protection
- Mechanical and motor construction
- Heavy industry
- Metallurgical engineering
- Composting facilities
- Sewage treatment plants

Description

Concept

The precision encoders in the GEL 295x series are designed as a modular, application-specific encoder system and consist of a housing component and the modular sensor system. All GEL 295x rotary encoders are manufactured according to drawings or application descriptions. The technical specifications may differ from the stated technical data. The modified specifications and assignment can be found in the customized dimensional drawing.

Design

The GEL 295x series encoders are extremely robust rotary encoders for measuring rotational movements or positions on machines and vehicles. Due to their high resistance to condensation, splash water and condensation, as well as the very wide temperature range of -40 °C to +120 °C, they are particularly suitable for use in rail vehicles or in heavy industry. The housing component is available with a solid shaft or hollow shaft including an integrated flexible precision hollow shaft coupling. The robust stainless steel housing has a flange dimension of 115 mm. The electrical connection is variable via connector or cable outlets.
The modular sensor system is a solution for many customer-specific requests. The GEL 295x offers particular advantages in terms of redundancy and reliability. The rotary encoder can be equipped with up to 5 electrically isolated sensors. Each customized version is marked with a Y number, which is appended to the product code (GEL 295xYxxx).

Assembly notes

The integrated precision hollow shaft coupling compensates for concentricity deviations, axial shocks and vibrations. The encoders are designed for assembly on an expansion shaft with a diameter of 20 g7. The expansion shaft must have an female thread, e.g. M12, to accommodate a headless screw with hexagon socket and must not protrude more than 15 mm into the hollow shaft coupling. The headless screw is screwed in with the hexagon socket first in the direction of the expansion shaft. A centering flange ensures the exact position of the precision encoder in the mounting fixture.

The precision encoder with solid shaft is connected to the motor shaft via a flexible coupling. The flexible clamp coupling type KK 14 is recommended. The size of the axial offset between the encoder shaft and the motor shaft directly influences the size of the angular error. This is particularly important 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. The sinusoidal signals can be converted into square-wave signals by the integrated evaluation electronics through interpolation.
The basic version can be supplied with signal patterns K, V, and X (see table). We will check the feasibility of other signal patterns upon request.

Available number of pulses

The pulse numbers that can be realized depend on the signal output. The version with sine/cosine differential signal, signal pattern K, outputs 256 pulses per revolution (smaller pulse numbers upon request). For signal patterns V and X, 150 or 256 pulses are output and interpolated. This results in the following number of pulses:
Number of pulses for signal patterns V and X

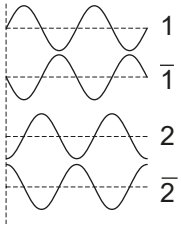
Input pulses	Interpolation factor						
	1	2	3	4	5	6	8
150	150	300	450	600	750	900	1200
256	256	512	768	1024	1280	1536	2048

Output signal level

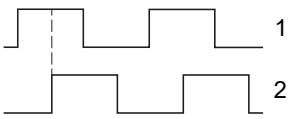
1 Vpp differential signals are output with signal pattern K. The signal patterns V and X have HTL level (for output voltage, see chapter “Technical Data”).

Available signal patterns

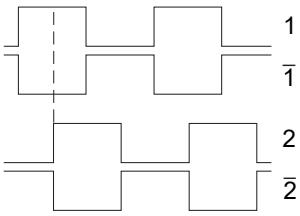
K Two sinusoidal signals phase-shifted by 90° and their inverse signals



V Two square-wave signals phase-shifted by 90°



X Two square-wave signals phase-shifted by 90° and their inverse signals



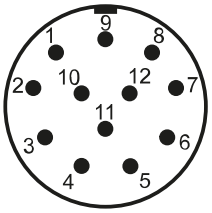
Technical data

Signal pattern	K	V	X
General			
Resolution	256 sin/cos periods(1)	150 to 2048(2)Pulses per revolution	
Short-wave accuracy (transducer and tooth errors)	360° x 0.006/pulse number		
Long-wave accuracy (concentricity error)	± 0.015°		
Electrical data			
Supply voltage U_B	15 V DC ± 5 %	10 to 30 V DC	
Power consumption without load	≤ 1.0 W		
Output signals	Differential signal	Square-wave signal(2)	
Output signal level	1 V_{pp}	High: U_B - 1 V, low: < 1.0 V(3)	
Maximum permissible cable length	100 m (consider voltage drop on supply cable)		
Mechanical data			
Housing	stainless steel, X12CrMoS17-1,4104		
Weight	approx. 3 kg		
Permissible coupling offset axial lateral	 ± 1.3 mm ± 0.2 mm		
Rotational speed range	0 to 6000 r.p.m.		
Bearing life	> 50 years (calculated). Due to the limited grease service life, the bearings should be replaced after a maximum mileage of 1,200,000 km (rail vehicles) or every 8 years.		
Environmental tests			
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: corresponding to the degree of protection of the motor or gear unit)		
Vibration resistance (DIN IEC 600068, Part 2-6)	200 m/s2		
Shock resistance (DIN IEC 60068, Part 2-27)	2000 m/s2		
Electromagnetic compatibility	Industrial applications: EN/IEC 61000-6-1 to 4 Rail vehicles: EN 50121-3-2		
Dielectric strength (EN 60439-1)	500 V AC		

(1) lower pulse numbers available on request
(2) obtained by interpolation of the sinusoidal signals,
150 or 256 pulses with interpolation factor: 1, 2, 3, 4, 5, 6, 8
(3) at 120 °C, 20 mA

Assignment

Assignment – Connector outlet

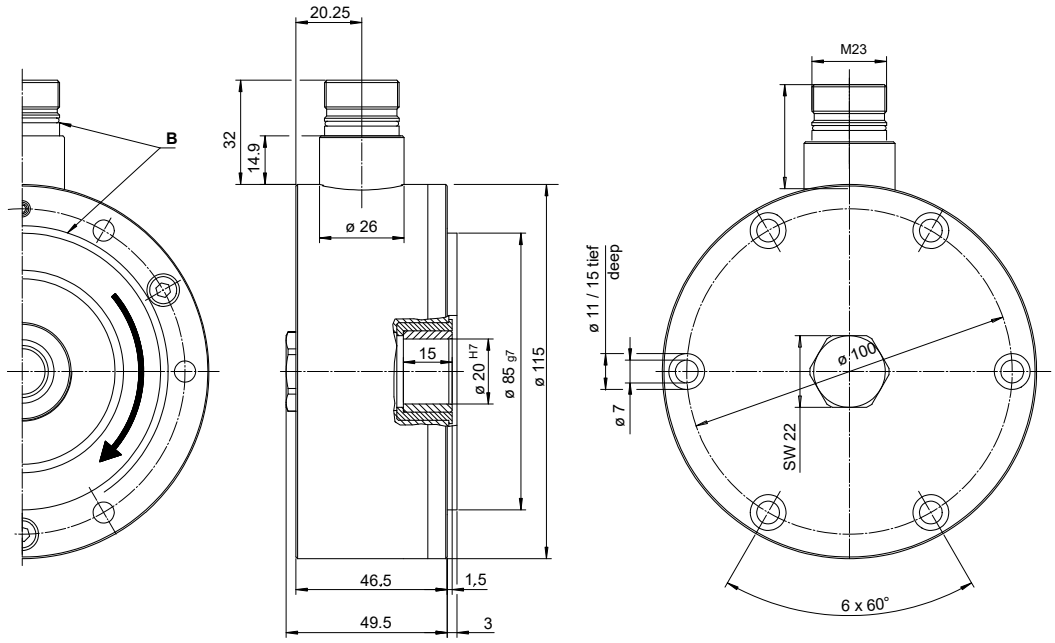
Assignment	Pin	Signal pattern K	Signal pattern V, X	Function
	1	/Spur2	/Spur2	Track 2, inverse
	2	—	—	unallocated
	3	—	—	unallocated
	4	—	—	unallocated
	5	Track 1	Track 1	Track 1
	6	/Track 1	/Track 1	Track 1 inverse
	7	—	—	unallocated
	8	Track 2	Track 2	Track 2
	9	—	—	unallocated
	10	0V (GND)	0V (GND)	Weight
	11	—	—	unallocated
	12	U_B 5 V DC	U_B 10 to 30 V	Supply voltage

Assignment – Cable outlet

Core color	Signal pattern K	Signal pattern V, X	Function
red	U_B 5 V DC	U_B 10 to 30 V	Supply voltage
blue	0V (GND)	0V (GND)	Weight
yellow	U_{A+}	Track 1	Track 1
black	U_{A-}	/Track 1	Track 1, inverse
white	U_{B+}	Track 2	Track 2
brown	U_{B-}	/Track 2	Track 2, inverse

Precision encoder with hollow shaft

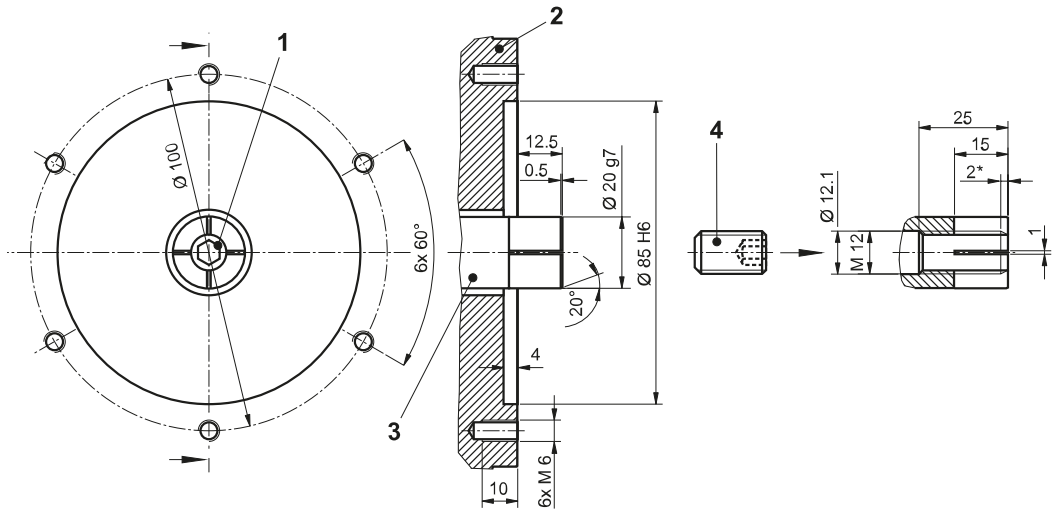
Dimensional drawing – Housing component with a sensor system



B Sealing ring (material: silicone)

All dimensions in mm

Assembly sketch and mating dimension

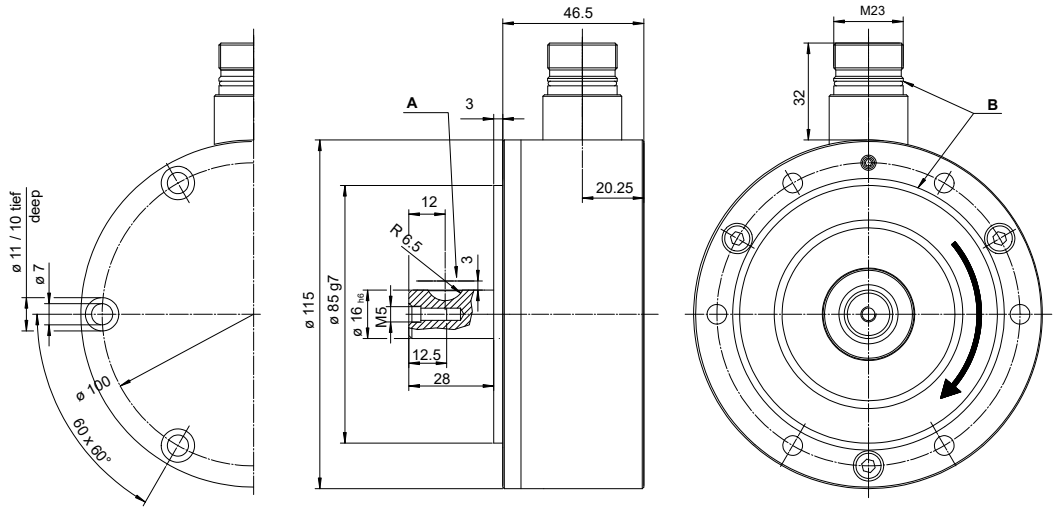


1 Visible hexagonal socket of setscrew EN ISO 4026 A2 M12 x 20
2 Mounting fixture (e.g. bearing cover) with centering
3 Expansion shaft
4 1 x Allen setscrew EN ISO 4026 A2 M12 x 20 screwed into the expansion shaft from the motor side

All dimensions in mm

Precision encoder with solid shaft

Dimensional drawing – Housing component with a sensor system



A for Woodruff key according to DIN 6888
B Sealing ring (material: silicone)

All dimensions in mm

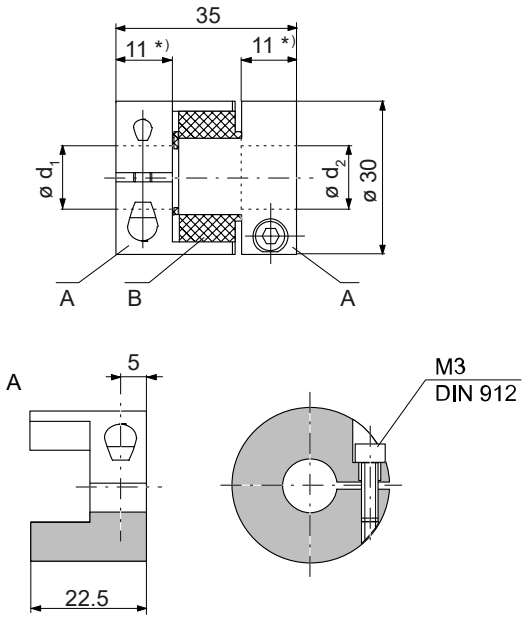
Dimensional drawing – Clamp coupling KK 14

2 identical coupling halves preloaded with form-fit, assembled backlash-free

	d_1	d_2	Standard d_1 / d_2
KK 14	6 to 16	6 to 16	6/6; 8/8; 10/10;12/12; 16/16
available with different diameters d_1 and d_2			

(1) Tolerance H7

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



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

All dimensions in mm

Type code GEL 295x

295x	Product type					
	Signal pattern **K** Two sinusoidal signals shifted by 90° and their inverse signals **V** Two square-wave signals shifted by 90° **X** Two square-wave signal shifted by 90° and their inverse signals					
		Reference signal **–** No reference signal				
			Number of pulses **00000** For signal patterns**K**: 00256 For signal patterns V and X**00150**or**00256**With interpolation factors 1, 2, 3, 4, 5, 6, 8 (1)			
				Connector/Cable outlet **D** 12-pin connector outlet, radial **G** 6-core cable outlet, radial		
					Shaft type **0** 20 mm hollow shaft with integrated flexible hollow shaft coupling, insulated **2** 16 mm solid shaft	
						Design **S** Special version A Y number is assigned, e.g. 2952Yxxx (xxx = consecutive no.); this identifies the customer-specific version according to the drawing or application description.
▼	▼	▼	▼	▼	▼	▼
295x	_	_	———	_	_	_ ◀**Product code**

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

Please contact our technical support to define the encoder according to your technical requirements.

Accessories

Description	Item number
Clamp coupling KK14, inside diameter: 6 to 16 mm (specify shaft diameter)	KK 14
Mating connector, M23, 12-pin straight, IP 65	GG 126
Mating connector, M23, 12-pin angled, IP 65	GW 126

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