Made in Germany

www.lenord.com

Technical Information

GEL 260

Magnetic incremental encoder

for heavy duty applications

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LENORD +BAUER

Finding solutions. Founding trust.

Motion sensors and integrated drive technology

General

- High-resolution magnetic incremental rotary encoders with robust mechanical design.
- Worldwide proven technology in various applications, suitable for harsh industrial environments
- Available with radial or axial connector or cable outlet
- Optionally available with pressure-resistant encapsulated housing, degree of protection IP 54, ATEX approval and IECEx approval.
- High reliability and long service life characterize the magnetic incremental encoders

Properties

- High resolution up to 273408 pulses per revolution
- Interpolation up to 1024-fold
- Optional additional current output 0 to 20 mA, 4 to 20 mA, -20 to + 20 mA
- Reference signal
- High electromagnetic compatibility

Advantages

- Absolute operational reliability even in case of high humidity (condensation) and frequent change of ambient temperature
- Withstands extreme impacts and vibration
- Resistant to dirt and oil
- No ageing of the magnetic sensor technology

Field of application

- Heavy industry
- Paper and packaging machines
- Bottling lines
- Transportation and storage systems
- Machines for processing steel, wood, stone, plastics, etc.

GEL 260

GEL 260 Ex

Description

Design

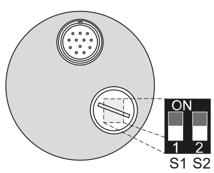
The magnetic incremental rotary encoders are based on contactless magnetic scanning of a target wheel integrated in the encoder. The resilient housing with a diameter of 90 mm is available with radial or axial connector or cable outlet. The solid encoder shaft is connected to the drive shaft via a flexible coupling. The diameter and length of the encoder shaft can be selected. Optionally, the GEL 260 can include, for example, a condensed water outlet or additional protection measures against humidity and vibration for harsh environmental conditions. Encoders with condensed water outlet must be mounted so that the condensed water outlet points downwards. For use in potentially explosive atmospheres, the GEL 260 is available in a pressure-resistant encapsulated housing with ATEX and IECEx approval and with a diameter of 115 mm. This model complies with degree of protection IP 54. Please note the modified technical data and the restricted type code for this version.

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.

Output signals

Square-wave signals are output with different signal patterns which provide a clear direction detection and high data reliability. Additionally, a reference pulse can be output. For display and control purposes, a standard measuring current of 0 to 20 mA, 4 to 20 mA or -20 to +20 mA can be obtained from the pulse frequency. The current depends on rotational speed and direction. For this purpose, the pulse frequency is integrated and converted into a speed-dependent output current. There is a strictly linear interrelation between measuring current and pulse frequency (see current outputs). The polarity of the direction-dependent measuring current can be reversed using DIP switch S2 on the rear of the device. For rotary encoders with signal pattern S, by reversing the measuring current polarity the direction-dependent S signal is also reversed. This can be reversed by switching DIP switch S1.

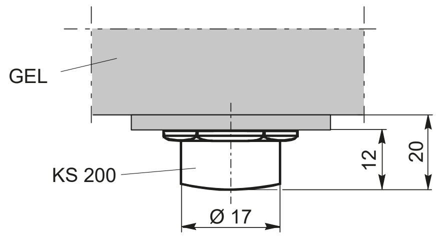


DIP switch behind the screw cap on the rear of the encoder

Available number of pulses

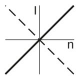
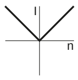
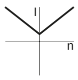
The high-resolution GEL 260 rotary encoders are available with pulse numbers ranging from 60 to 273,408 pulses per revolution. The realizable pulse numbers can be found online atwww.lenord.deand are available upon request.

Additional protective measures

Protection against humidity
The encoder electronics are coated with a highly effective protection against humidity, salt water atmosphere and corrosive vapors. This ensures years of trouble-free operation even in harsh environments.
Condensed water outlet
Water can accumulate in the encoder if condensation is present repeatedly. This water can drain off through the condensed water outlet. When installing the encoder, make sure that the outlet points downwards. The degree of protection goes down to IP 64.  The position of the condensed water outlet must be specified when ordering.
Vibration protection
By additionally fixing mechanical parts with special plastic, vibrations of the electronics and connection technology in the encoder are prevented. This enables flawless continuous operation even under extreme vibration and shock loads.

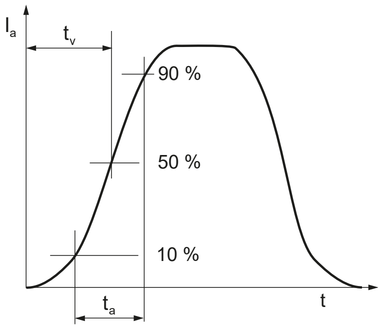
Current outputs

Current output – Options

A:		Direction of rotation-dependent measuring current Nominal range: -20 to + 20 mA (reversible)
B:		Direction of rotation-independent measuring current Nominal range: 0 to + 20 mA
C:		Direction of rotation-independent measuring current nominal range: +4 to +20 mA.

General

Due to the high resolution (60 to 273,408 direction of rotation-dependent pulses per revolution), a DC output current (I_a) with a low harmonic content is obtained even at a very low rotational speed range (for example, 0 to 0.5 r.p.m.). The harmonic content depends on the pulse frequency and the selected attenuation d, the latter influencing the rise and fall time (t_a) as well as the delay time (t_v) in case of an erratic change in rotational speed.



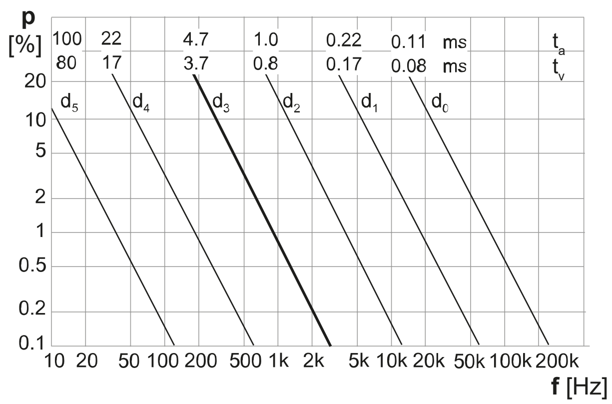
Rise time t_a and delay time t_v after a erratic change in speed

I_a DC output current

Attenuation

The attenuation is adjusted according to the diagram below. The desired factory default setting must be specified in the order. Default is set to d_3. The rotational speed for the maximum current of 20 mA, which was specified in the order, is indicated on the rating plate (for example, 4000 r.p.m.). The attenuation is factory set so that the harmonic content p at rated speed is ≤ 1 %, it is also indicated on the rating plate (for example, ‘d5’).

Harmonic content of the output current as a function of the pulse frequency (f) and the selectable attenuation (d_n)



d	Attenuation
f	Effective pulse frequency (= n×i)
p	Harmonic content (= I_{eff}/I_a)
t_a	Rise time (= f(d))
t_v	Delay time (= f(d))

Technical data

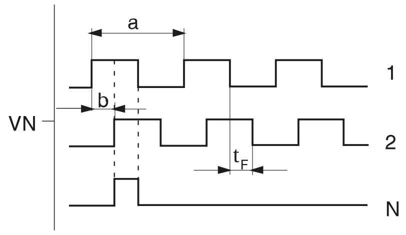
Current output		
Maximum burden	R_a	550 Ω
Instrument class	K	1
Rated current tolerance		< 1 %
Linearity error		< 1 %
Reproducibility	r	100 %
Temperature drift	ΔI_{aT}	< ±3 µA/1 K
Minimum rotational speed (for attenuation d_5)	$n_{min\ electrical}$	1.5 x 10^3/i r.p.m.
Maximum rotational speed	$n_{max\ electrical}$	6 x 10^6/i r.p.m.

i = rated number of pulses

Output signals

Signal pattern V, VN

The “V” signal pattern refers to two tracks with square-wave signals offset by 90°. On the third track N a reference signal of defined length is output once per revolution.



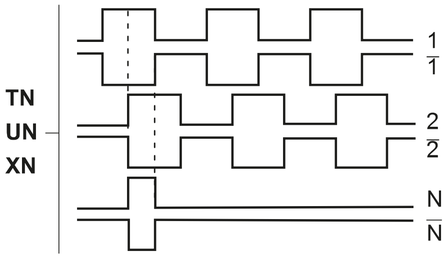
a	360° electrical
b	90° phase offset
t_F	Time between edges (at an output frequency of 200 kHz the time between edges is t_F > 0.6 µs)

	U_B (1)	U_{out}(2)
V, VN	10 to 30 V DC	HTL

(1) Supply voltage
(2) Output signal level

Signal pattern T, TN, U, UN, X, XN

The two pulse outputs and the reference signal are also output as inverse signals.

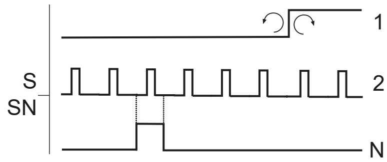


	U_B (1)	U_{out}(2)
T, TN	+ 5 V DC ± 5 %	TTL
U, UN	10 to 30 V DC	TTL
X, XN	10 to 30 V DC	HTL

(1) Supply voltage
(2) Output signal level

Signal pattern S, SN

Pulses independent of the direction of rotation and of constant duration are derived from the square-wave signals as per signal pattern V and are output on the second track. In addition, a signal dependent on the direction of rotation is obtained from the signal pattern (counting direction) and is output on the first track. On the third track N (option) a reference signal is output once per revolution. The pulses follow a possible change in the direction of rotation with a short delay so that any downstream counting circuit can be set to the counting direction prior to the pulse.



	U_B (1)	U_{out}(2)
S, SN	10 to 30 V DC	HTL

(1) Supply voltage
(2) Output signal level

Output signal level

The signal patterns S, SN, V, VN, X and XN have HTL output signal levels, the signal patterns T, TN, U and UN have TTL output signal levels. All outputs have a push-pull power amplifier and have sustained short circuit protection. The peak output current for discharging the cable capacitance is 100 mA.

Maximum cable lengths

Signal pattern		at output frequency f of						
		5	**10**	**20**	**50**	**100**	**200**	**[kHz]**
T, TN, U, UN	TTL (U_{out} = 5 V)	200	200	200	200	145	72	[m]
S, SN, V, VN	HTL (at U_{out} = 20 V)	200	200	200	80	40	20	[m]
X, XN	HTL (at U_{out} = 20 V)	200	200	100	40	20	10	[m]

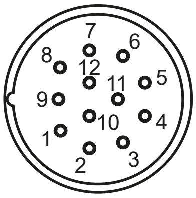
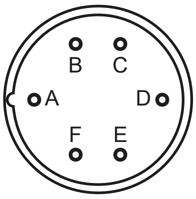
Technical data

Signal pattern	T, TN	U, UN	S, SN	V, VN	X, XN
General					
Resolution (pulses per revolution)	60 to 273408				
Measuring range	36° to 0.0013°				
Error limit	0.07°(1)				
Measuring step deviation	0.01°(1)				
Repeatability	0.005°(1)				
Electrical data					
Operating voltage	5 V DC ± 5 %	10 to 30 V DC			
Power consumption	≤ 1.0 W / ≤ 1.4 W(2)	≤ 1.3 W / ≤ 1.65 W(2)			
Output frequency	≤ 200 kHz(3)				
Output signal level	TTL		HTL		
Output level high	≥ U_B - 1.00 V at I = 10 mA; ≥ U_B - 1.20 V at I = 30 mA	4.00 V atI = 10 mA; ≥ 3.85 V atI = 30 mA	≥ U_B - 1.80 V at I = 10 mA; ≥ U_B - 2.20 V at I = 30 mA		
Output level low	≤ 0.75 V at I = 10 mA; ≤ 1.00 V at I = 30 mA		≤ 1.15 V at I = 10 mA; ≤ 1.55 V at I = 30 mA		
Mechanical data					
Shaft diameter	6, 8, 10, 12 mm				
Housing diameter	90 mm(4)				
Weight	700 g(4)				
Maximum operating speed	10,000 r.p.m. (5)				
Moment of inertia of rotor	7.5×10^{-5} kgm^2				
Operating torque	0.03 Ncm (< 0.1 Nm(6))				
Starting torque	0.05 Nm (0.1 Nm(6))				
Permissible shaft load (Point of application 15 mm in front of flange)	200 N axial, 200 N radial				
Bearing life at max. shaft load at half shaft load	 2000×10^6 revolutions 12600×10^6 revolutions				
Environmental conditions					
Working temperature	0 °C to +70 °C(5)/ -20 °C to +85 °C (operating temperature) / -20 °C to +85 °C (optional)				
Storage temperature range	-40 °C to +105 °C				
Degree of protection	IP 65(5), IP 64(7)				
Vibration resistance (DIN EN 600068-2-6)	100 m/s^2, (10 to 2000 Hz				
Shock resistance (DIN EN 60068-2-27)	1000 m/s^2, 11 ms				
Electromagnetic compatibility	EN 61000-6-1 to 4				
Insulation resistance	500 V DC, > 1 MΩ				
Voltage sustaining capability	500 V AC, 1 minute				

(1) Value at maximum resolution, values for lower resolutions upon request
(2) with current output
(3) more details upon request
(4) modified values for Ex version (see table)
(5) Standard
(6) with option ball bearing cover plate (IP 50)
(7) with condensed water outlet

Assignment

Assignment – Connector outlet

Signal	with connector outlet type		Description
	C / D	A / B	
	12-pin 	6-pin 	
U_B	12	F	Operating voltage
GND	10	A	Weight
1	5	C	Channel 1
/1	6	-	Channel 1, inverted
2	8	B	Channel 2
/2	1	-	Channel 2, inverted
N	3	D	Reference signal
/N	4	-	Reference signal, inverted
A/ B/ C	7	E	Current output
U_{Sense+}	2	-	+ Sense (U_B)(1)
U_{Sense-}	11	-	- Sense (GND)

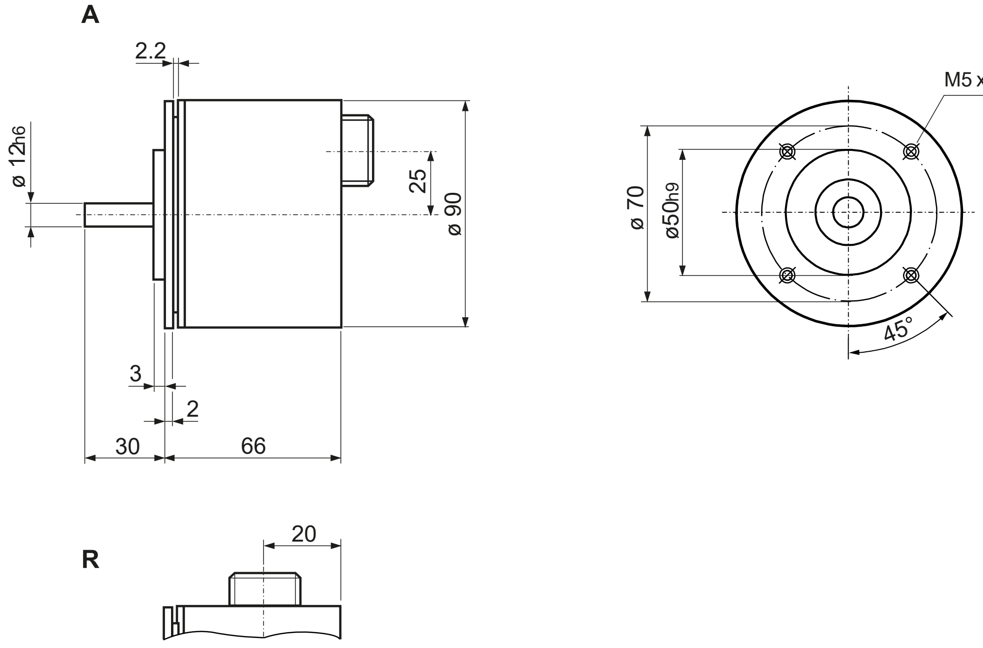
(1) If the sense function is not used, use the free cables for the power supply, i.e. halve the voltage drop by connecting in parallel.

Assignment – Cable outlet

Signal	GEL 260 with outlet type		GEL 260 Ex with outlet type		Description
	F / G	H / I	E	K	
	6-core	10-core	7-core, numbered	12-core, numbered	
U_B	yellow	red	6	6	Operating voltage
GND	green	blue	1	1	Weight
1	brown	white	3	3	Channel 1
/1	-	brown	-	8	Channel 1, inverted
2	white	pink	2	2	Channel 2
/2	-	black	-	7	Channel 2, inverted
N	gray	violet	4	4	Reference signal
/N	-	yellow	-	9	Reference signal, inverted
A/ B/ C	pink	gray	5	5	Current output
		green	7	10, 11, 12	unallocated

Dimensional drawings

Dimensional drawing GEL 260

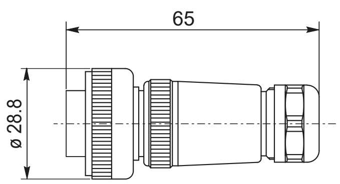


A Axial connector outlet
R Radial connector outlet

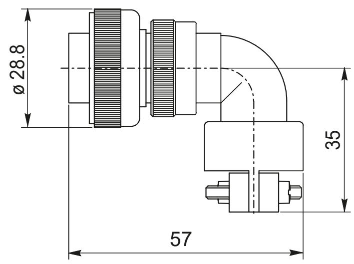
Dimensions in mm

Dimensional drawings Mating connectors

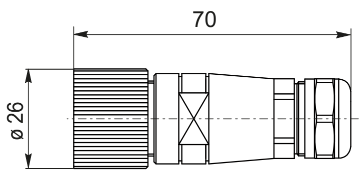
BS1111= GG 66 6-pin, straight



BS1113= GW 66 6-pin, angled



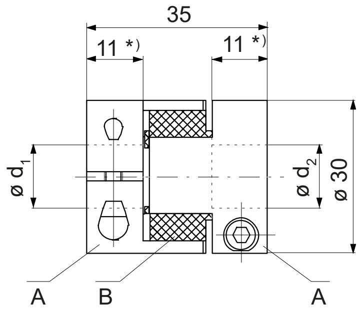
FS1139= GG 126 12-pin, straight

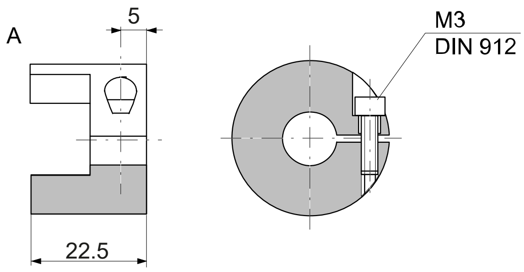


Dimensions in mm

Dimensional drawings Couplings

Clamp couplingKK 14
(2 identical coupling halves preloaded with form-fit, assembled backlash-free)



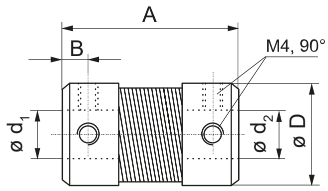


*) Maximum dimension for inserted shaft
A Coupling half
B Involute annular gear

	d_1 (1)	d_2 (1)	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			

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

Metal couplingMK 8 / MK 12

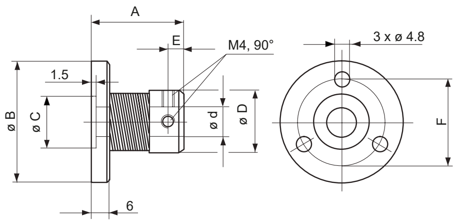


MK 8 Material: X12CrNi18-8 (V2-A)
MK 12 Material: ST

	A	B	D	d_1 (1)	d_2 (1)	Standard d_1 / d_2
MK 8	35	5	21	5 to 12	5 to 12	6/6; 8/8; 10/10; 12/12
MK 12	50	7	26 (2)	6 to 15	6 to 15	12/12
available with different diameters d_1 and d_2						

permissible misalignment of the nominal shaft diameter: 3° or 3 %

Screw-down couplingMKF 8 / MKF 12



	A	B	C (1)	D	E	F	d (1)	Standard d_1 / d_2
MKF 8	30	42	18	21	5	30	6 to 10	6; 8; 10
MKF 12	40	48	21	26 (2)	7	37	8 to 15	12

permissible misalignment of the nominal shaft diameter: 3° or 3 %
Mount clutch preloaded to 1 mm

(1) Tolerance H7
(2) available with woodruff key slot

Encoder with Ex protection

General notes GEL 260 Ex

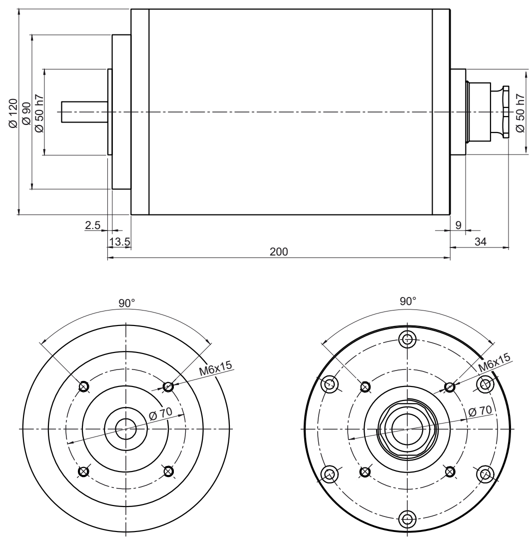
The GEL 260 rotary encoder with ATEX and IECEx approval may only be operated in Zone 1. The mechanical and electrical characteristics specified in the GEL 260 operating instructions, such as temperature, max. load current, max. supply voltage, and mechanical load, must not be exceeded under any circumstances.

The GEL 260 may only be operated in the approved degree of protection. The operating company is obliged to conduct a risk assessment. Only the variants with cable outlet E or K in conjunction with an Ex connecting housing are approved for connection. The type code is restricted.

Type code for Ex protection

Feature	Possible variant
Current output Signal pattern Reference signal Number of pulses per revolution	without restriction
Connector/Cable outlet	E, K
Shaft diameter/length	0
Additional protective measures	6, 7, 8, 9
Temperature range	1

Dimensional drawing GEL 260 for potentially explosive atmosphere (BARTEC)



Modified technical data GEL 260 Ex

Mechanical data	
Housing diameter	115 mm
Weight	5.1 kg
Maximum operating speed	3000 r.p.m.
Starting torque	0.06 Nm
Safety characteristics	
Ignition protection	II 2G Ex db IIC T6 Gb
Test number	EPS 14 ATEX 1 696 X; IECEx EPS 14.0042X
Degree of protection	IP 54 pressure-resistant

Type code GEL 260

260

Code	Current output
-	without current output
A	Current range -20 mA to +20 mA (1)
B	Current range 0 mA to +20 mA (1)
C	Current range +4 mA to +20 mA (1)

Code	Signal pattern
-	without signal output
S	Signal pattern S, logic level HTL
T	Signal pattern T; logic level TTL (2)
U	Signal pattern U; logic level TTL (2)
V	Signal pattern VN; logic level HTL
X	Signal pattern XN; logic level HTL (2)

Code	Reference signal
-	without reference signal
N	with reference signal

Code	Number of pulses
XXXXXX	Number of pulses per revolution (60 to 273,408)

Code	Connector/Cable outlet	Code	
A	6-pin connector, axial (3)	F	6-core cable (4), axial
B	6-pin connector, radial (3)	G	6-core cable (4), radial
C	12-pin connector, axial (3)	H	10-core cable (4), axial
D	12-pin connector, radial (3)	I	10-core cable (4), radial
E	7-core cable (4) (only for GEL 260 Ex)	K	12-core cable (4) (only for GEL 260 Ex)

Code	Shaft diameter/length
0	d = 12 mm, L = 30 mm (for GEL 260 Ex d = 12 mm, L = 27 mm)
1	d = 6 mm, L = 13 mm
2	d = 8 mm, L = 30 mm
3	d = 8 mm, L = 30 mm, shaft with Woodruff key (DIN 6888)
4	d = 10 mm, L = 30 mm
5	d = 10 mm, L = 20 mm Woodruff key
6	d = 10 mm, L = 30 mm, shaft with Woodruff key (DIN 6888)
7	d = 12 mm, L = 30 mm, shaft with Woodruff key (DIN 6888)

Code	Additional protective measures
0	without additional protective measures
1	Humidity protection
2	Vibration protection
3	Humidity and vibration protection
4	Humidity protection and condensed water outlet (5)
5	Humidity protection and condensed water outlet (5) and vibration protection
6	Degree of protection Ex without additional protective measures
7	Degree of protection Ex with humidity protection
8	Degree of protection Ex with vibration protection
9	Degree of protection Ex with humidity and vibration protection

Code	Temperature range
1	0 °C to +70 °C
3	-20 °C to +85 °C (extended)

260 _ _ _ ______ _ _ _ _ ◄**Product code**

(1) Specify nominal speed for I_{max}
(2) Only with connector/cable outlet option: C, D, H, I, K
(3) Mating connector, straight, included in scope of supply (optional mating connector, angled available)
(4) Standard cable length 1 m (specify other cable lengths when ordering)
(5) Specify position when ordering

Accessories

Assembly accessories

Description	Item number
Screw-down coupling MKF 8: inside diameter 6 to 10 mm (specify shaft diameter, standard: 6, 8, 10 mm)	MKF 8
Screw-down coupling MKF 12: inside diameter 8 to 15 mm (specify shaft diameter, standard: 12 mm)	MKF 12
Clamp coupling KK14, inside diameter: 6 to 16 mm (specify shaft diameter)	KK 14
Clamping element (set of 4 pieces)	KL 260
Metal coupling MK 8, inside diameter: 5 to 12 mm (specify shaft diameter)	MK 8
Metal coupling MK 12, inside diameter: 6 to 15 mm (specify shaft diameter)	MK 12
Mounting bracket for rotary encoder GEL 260, die-cast aluminum	MW 92
Mounting flange, die-cast aluminum, diameter 120 mm	MF 121
Measuring wheel, die-cast aluminum, hard anodized surface (approx. 700 HV), Circumference 500 mm ± 0.3 mm, incl. collet chuck	MRM 500
Measuring wheel, die-cast aluminum, rubberized surface (Shore approx. 70, coating: Perbunan), circumference 500 mm ± 0.8 mm, incl. collet chuck	MRG 500
Collet chuck for assembly of MRM 500/MRG 500, for shaft diameters 8, 10 or 12 mm	SP 08/SP 10/SP 12
Protective housing with 5 x PG21 cable entries	SG 110
Protective housing with 6 x PG21 cable entries	SG 111

Connection accessories

Description	Item number
Mating connector, M23, 12-pin straight, IP 65	GG 126
Mating connector, 6-pin straight, IP 65	GG 66
Mating connector, 6-pin angled, IP 65	GW 66

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