Magnetic absolute rotary encoder
GEL 2352
with SSI or CANopen interface

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... automates motion.

Technical information ***Version 2014-07***

GEL 2352 with clamping flange , SSI

GEL 2352 with semi hollow shaft, CANopen interface

General

- Absolute rotary encoder with a maximum total resolution of 28 bits in a compact design
- Encoder series includes single turn variants with up to 16-bit resolution and multiturn variants with up to 12-bit resolution
- Magneto-resistive scanning of a ferromagnetic steel disc provides unambiguous position values at every angular position via digital interfaces
- Evaluation based on Vernier principle
- Optionally with stainless steel housing

Features

- 28-bit total resolution
- Mechanical gear
- High accuracy ± 0.08°
- Interfaces:
  - SSI
  - CANopen
- Operating temperature -40 °C to +105 °C
- Protection class up to IP 67

Advantages

- Suitable for all standard applications and also for real heavy-duty applications
- Full function in case of condensation: **dew-point resistant!**
- Extremely resilient housing made of anodised aluminium, stainless steel variant available
- Not affected by dirt or oil mist
- Withstands very high shock and vibration loads as well as acceleration forces

Field of application

- General mechanical engineering
- Regenerative energies
- Mobile machines

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Description

Construction and design

The resilient encoder housing with a standard flange size of 58 mm is made of anodised aluminium and can be supplied alternatively in stainless steel.
The double-bearing encoder shaft forms a robust mechanical unit with the metal code disc. The multiturn variant operates with a mechanical gear.
A uniform temperature coefficient on all rotating components ensures the temperature behaviour of the absolute rotary encoder is stable over the long-term.

Sensing principle

The GEL 2352 is based on contactless magnetic scanning of a ferromagnetic steel code disc, the so-called contour disc. Magnetoresistive (MR) sensors scan three tracks, delivering corresponding sinusoidal signals. The phase position of the three sinusoidal signals is unambiguous within a single turn. The phase position is evaluated on the Vernier principle, providing the absolute position with high resolution and accuracy.

Interfaces

The absolute rotary encoder supplies the position values either in binary or gray code via a fast synchronous serial interface (SSI) or as per encoder profile DS406 via a CANopen interface.

Temperature ranges

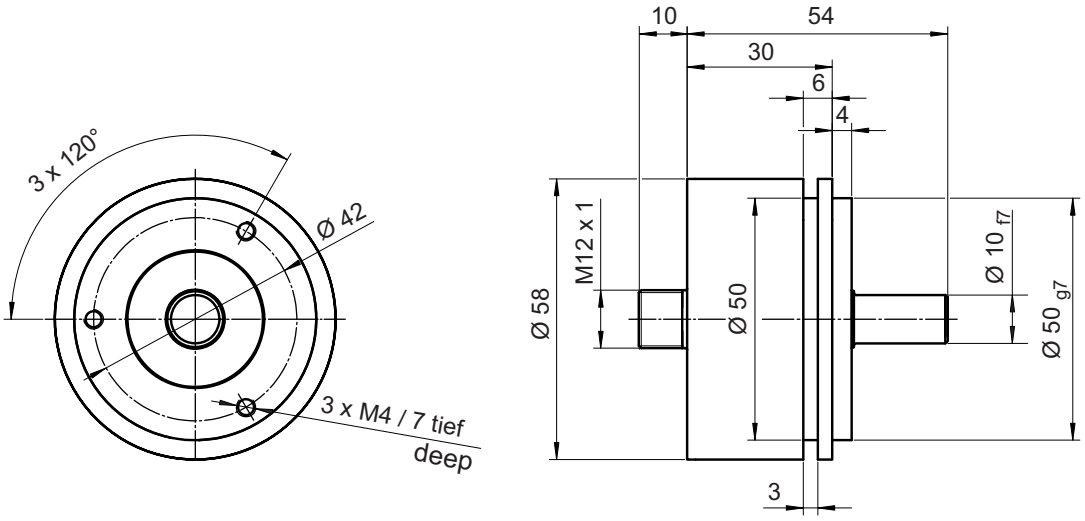
High precision SMD components are used in the absolute rotary encoder. Despite careful selection, thermal ageing of these components cannot be excluded. For this reason the encoder should be stored at a temperature from -40 °C to +85 °C.
Operating temperatures of -40 °C to +105 °C are allowed, an installed absolute rotary encoder is not allowed to exceed this temperature range. The function of the absolute rotary encoder is ensured within the operating temperature range allowed, (DIN 32878); here it is the temperature at the encoder housing that applies.
The temperature of the absolute rotary encoder is affected by the installation situation (thermal conductance, thermal radiation), the heating caused by the absolute rotary encoder (bearing friction, electrical power loss) and the ambient temperature. The operating temperature may be higher than the ambient temperature depending on the operation of the absolute rotary encoder.
Depending on the supply voltage the heating caused by the encoder can be up to 10 °C. At high operating speeds > 5,000 min^{-1} the heating caused by the encoder can be up to 20 °C due to the bearing friction.
If the absolute rotary encoder is operated close to the limits of the specifications allowed, the ambient temperature must be reduced by suitable means (cooling) such that the operating temperature range allowed is not exceeded.

General	
Accuracy	± 0.08°
Repeatability	< 0.01°
Electrical data	
Operating voltage	10 to 30 V DC with reverse voltage protection
Power consumption	< 1 W
Resolution single turn	8, 9, 10, to 16 bit (measuring steps over 360°)
Resolution multiturn	12 bit (revolutions, mechanical gear)
Interface	SSI (gray / binary), CANopen encoder profile DS406
Mechanical data	
Moment of inertia of rotor	611.8 x 10^{-6} kgm^2
Material	Aluminium anodised stainless steel 1.4101
Weight singleturn	Aluminium: 250 g, stainless steel: 480 g
Weight multiturn	Aluminium: 290 g, stainless steel: 555 g
Operating speed (limit value)	6,000 min^{-1}
Operating torque	< 3 Ncm
Bearing life	10^5 h at 1,000 min^{-1}
Shaft sealing ring (option)	Material: Viton, protection class IP 67 / 69K
Ambient data	
Working temperature range	-40 °C to +85 °C
Operating temperature range	-40 °C to +105 °C
Storage temperature range	-40 °C to +85 °C
Protection class	IP 64, IP 67
Vibration protection (DIN EN 60068-2-6)	200 m/s^2, 10 to 2000 Hz
Shock protection (DIN EN 60068-2-27)	2000 m/s^2, 11 ms
EMC	EN 61000-6-1 to 4
Insulation strength	Ri > 1 MΩ, at a testing voltage of 500 V AC
Relative humidity of air max.	99 %
Condensation	permissible, according to DIN EN 60068-2-30 Part 2 of 1999
Clamping flange	
Shaft load (radial/axial)	90 N / 70 N at 1000 min^{-1}
Synchro flange	
Shaft load (radial/axial)	90 N / 70 N at 1000 min^{-1}
Semi hollow shaft	
Shaft load (radial/axial)	75 N / 70 N at 1000 min^{-1}

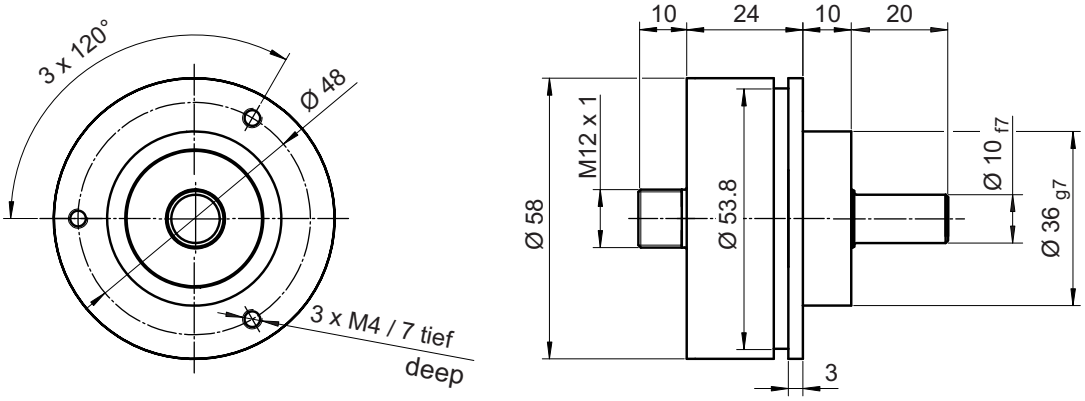
Dimensional drawings

Dimensional drawings GEL 2352 – SSI (single turn)

Synchro flange



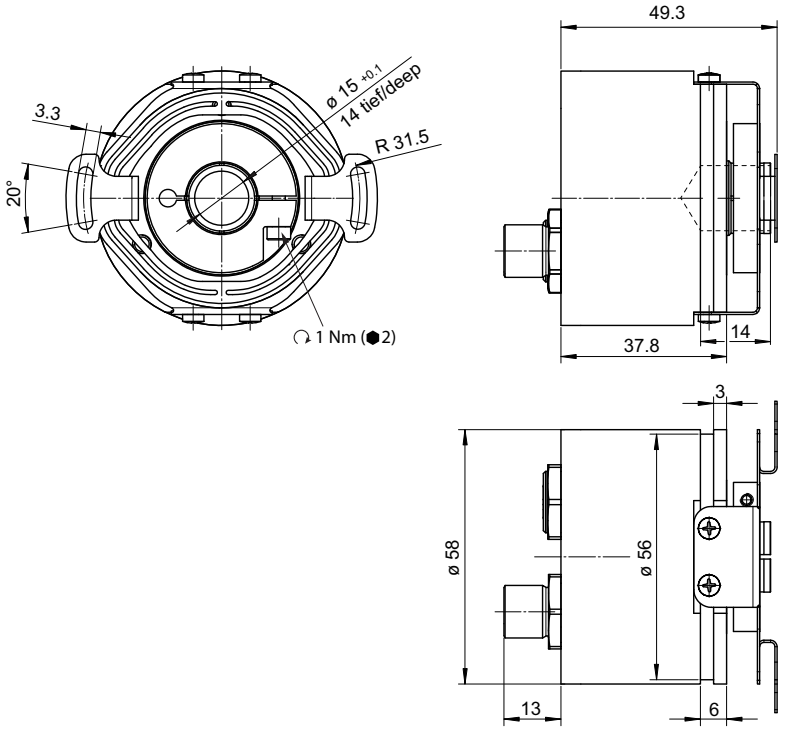
Clamping flange



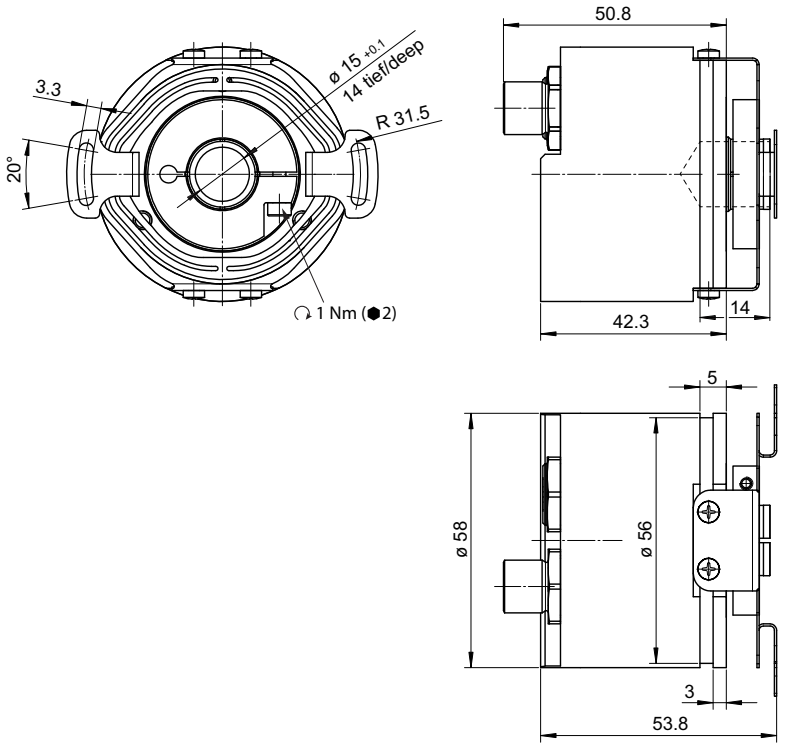
All dimensions stated in mm

Dimensional drawings GEL 2352 – CANopen

Semi hollow shaft; single turn



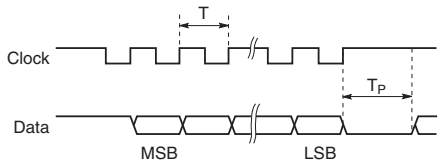
Semi hollow shaft; multiturn



All dimensions stated in mm

Synchronous serial interface

The synchronous serial interface transfers the position data at a clock frequency of up to 2 MHz. Prior to further position sampling, a minimum clock pulse space of 16 µs must be met.



Principle of the serial data transmission [gray code (25 bits), RS 422 / RS 485 standard]

f > 62.5 kHz

T Length of the clock signal period (= 1/clock frequency)

T_p Clock pulse space,
between the clock sequences T_P At least 16 µs

Cable length

With the synchronous serial interface protocol the transmission rate allowed drops with increasing cable length. A screened, twisted pair cable is recommended for the signal cables (± CLOCK and ± DATA).

Cable length [m]	< 50	< 100	< 200	< 400
Clock frequency [kHz]	< 400	< 300	< 200	< 100

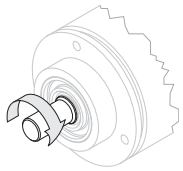
Direction of rotation

The encoder can output increasing position values on the clockwise or counter clockwise rotation of the shaft. The direction of rotation can be selected by using the CW/CCW input (counting direction).

Position values on the clockwise rotation of the shaft

Standard:
GND on CW/CCW
or not connected: Increasing pos. ↑

Inverse:
V_S on CW/CCW: Reducing pos. ↓

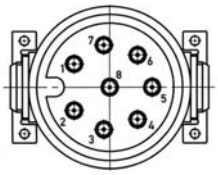


PRESET function

The output signals can be set to a PRESET value from any position. As supplied the encoder is set to half the maximum resolution. The PRESET is set electronically if the supply voltage V_S is briefly t > 100 ms applied to the PRESET input (do NOT apply continuously). Other PRESET values are available on request.

Pin layout – SSI

M12 connector, 8-pin



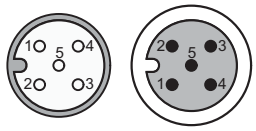
Pin	Signal	Description
1	GND	Earth
2	Preset	Electronic adjustment V_S, t > 100 ms
3	DATA–	Output: Differential data signal in accordance with RS 485
4	DATA+	
5	CLOCK–	Input: Differential clock signal in accordance with RS 485
6	CLOCK+	
7	V_S	Operating voltage
8	CW/CCW	Direction of rotation: Default = GND; Inverse =V_S

Technical data SSI

Output code	binary, gray
Driver	RS 485 compatible
Clock frequency	max. 2 MHz
Transmission	Max. 1,200 m depending on transmission rate
The immunity to interference	high immunity to interference via symmetrical transmission
Direction of rotation	adjustable, standard clockwise (CW) with view on the encoder shaft, increasing position values
PRESET	about input level
Cable	halogen-free PUR (6 x 2 AWG, shielded)

Pin layout – CANopen

M12 connector
A-coded



Pin/socket layout

Pin	Bus IN	Bus OUT
1	CAN_GND	CAN_GND
2	$+V_S$ IN	$+V_S$ OUT
3	GND	GND
4	CAN_H	CAN_H
5	CAN_L	CAN_L

Technical data CANopen

Device profile	CANopen DS406 with additional function
Cable diameter	8 mm
Programmable parameters	Resolution, PRESET, offset, counting direction, speed, acceleration and rotational speed output, range output referred to pre-defined values, scalable number of steps (decimal/binary)
Output code	Binary
Baud rate	50 kbit/s … 1 Mbit/s can be set via bus master
Sensor ID	0 … 99, can be set via bus master
Terminating resistor	To be provided externally
Operating temperature	-40 … +85 °C (shorttime 100 °C)

Type code GEL 2352

		Interface					
	SG	SSI Gray					
	SB	SSI binary					
	CO	CANopen					
		Resolution per revolution					
		08	8 bit, 256 steps/revolution				
		09	9 bit, 512 steps/revolution				
		10	10 bit, 1024 steps/revolution				
		11	11 bit, 2048 steps/revolution				
		12	12 bit, 4096 steps/revolution				
		13	13 bit, 8192 steps/revolution				
		14	14 bit, 16384 steps/revolution				
		15	15 bit, 32768 steps/revolution				
		16	16 Bit, 65536 steps/revolution				
			Number of revolutions				
			00	Single turn			
			12	12 bit - 4096 revolutions			
				Flange, Shaft			
				B	Camping flange, D = 10 mm / L = 20 mm		
				D	Synchro flange, D = 10 mm / L = 20 mm		
				E	Semi hollow shaft, D = 15 mm / L = 14 mm		
					Electrical interface		
					1	M12-connector, 8-pole, axial	
					2	2x M12 plug/socket CANopen	
						Material	
						1	Aluminium
						2	Stainless steel 1.4104
							Option
							0 None
							1 Shaft sealing ring
2352	_ _	_ _	_ _	_	_	_	_

Customer-specific designs

Customer-specific modifications to mechanical and electrical features are in principle possible.

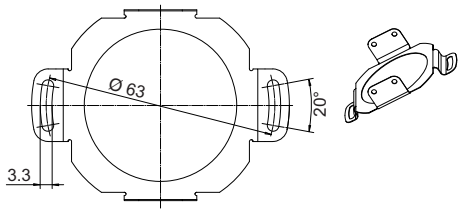
Restriction of the type code for SSI

Feature	Possible variant
Number of revolutions	00, single turn
Flange, shaft	B, D
Electrical interface	1

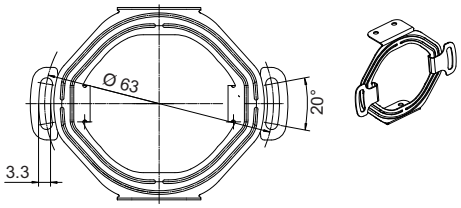
Restriction of the type code for CANopen interface

Feature	Possible variant
Flange, shaft	E
Electrical interface	2
Material	2

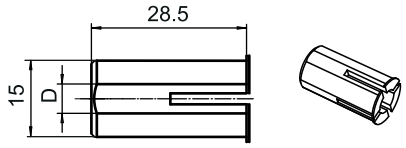
Torque support FB23504



Torque support FB23505
(standard with semi hollow shaft)

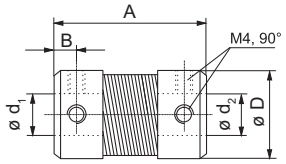


Bushing



Order no.		D
POM	Brass	
RH 23501	RH 23504	8 mm
RH 23502	RH 23505	10 mm
RH 23503	RH 23506	12 mm

Metal coupling MK 8 / MK 12

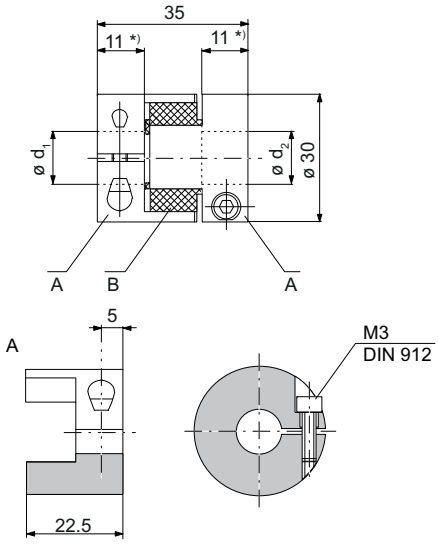


MK 8 Material: X12CrNi18-8 (V2-A)

MK 12 Material: ST

	A	B	D	d_1 (1)	d_2 (1)	d_1 / d_2
MK 8	35	5	21	5 … 12	5 … 12	6/6; 8/8; 10/10;12/12
MK 12	50	7	26	6 … 15	6 … 15	12/12

Clamp coupling KK 14

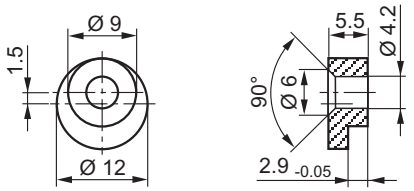


A Coupling half

B Involute annular gear

	d_1 (1)	d_2 (1)	d_1 / d_2
KK 14	6 … 16	6 … 16	6/6; 8/8; 10/10;12/12; 16/16

Clamping elements KL200
(3 pieces)



(1) Tolerance H7

Accessories

Ordering overview for mounting accessories

Description	Item number
Torque support, hard[1]	FB 23504
Torque support, soft[1]	FB 23505
Clamping elements (3 pieces)	KL 200
Metal coupling, inside diameter: 5 to 12 mm (state shaft diameter)	MK 8
Metal coupling, inside diameter: 6 to 15 mm (state shaft diameter)	MK 12
Clamp coupling KK14, inside diameter: 6 to 16 mm (state shaft diameter)	KK 14

Ordering overview for connection accessories

Description	Item number
8-pin M12 mating connector SSI, straight	FS 1352
Connection cable 10 m, 8-pin M12 socket, angled / flying lead	FS 1095
M12 mating connector CANopen, 5-pin socket, A-coded	FS 3020
M12 mating connector CANopen, 5-pin plug, A-coded	FS 3021
CANopen connection cable 10 m, 5-pin plug / flying lead with ferrules	BK 2100
CANopen connection cable 2 m, 5-pin plug / flying lead with ferrules	BK 2101
CANopen connection cable 10 m, 5-pin socket / flying lead with ferrules	BK 2102
CANopen connection cable 2 m, 5-pin plug / flying lead with ferrules	BK 2103
CANopen connecting cable 10 m, 5-pin socket/plug	BK 2104
CANopen connecting cable 10 m, 5-pin socket/plug	BK 2105
CANopen terminating resistor M12	FS 3040

[1] The GEL 2352 with semi hollow shaft is supplied as standard with a soft torque support FB 23505 mounted. If the alternative torque support FB 23504 is to be mounted, it must be stated on the order.

Your notes:

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