

General

- Customer-specific encoder system for mounting on ends of axles
- Combination of Cold Movement Detection and incremental encoder
- Magnetic *Cold Movement Detection* (CMD)
- Screened magnetic-incremental rotary encoder system
- For mounting on bogies with outside bearings

Features

- Resolution of the rotary encoder: 80 pulses per revolution⁽¹⁾
- Degree of protection (overall system): IP66, IP 67
- Housing material: Aluminium, coated

Advantages

- The Cold Movement Detection detects movements of the wheel axle in the de-energised state
- Energy self-sufficient, no batteries required
- Maintenance-free, durable operation in the harshest ambient conditions due to a magnetic measuring system

Field of application

- Rail vehicles



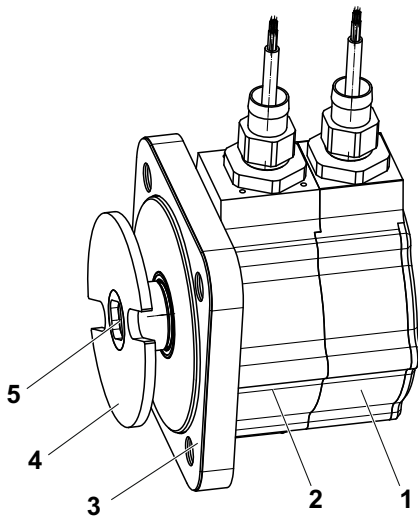
⁽¹⁾ Other numbers of pulses upon request

Right to technical changes and errors reserved.

Description

Design

The axle encoders in the series GEL 2740 are application-specific encoder systems intended for use in rail vehicles. The basic module of the system is the encoder for Cold Movement Detection [1]. It can be extended using an independently operating incremental encoder [2]. The system is mounted on the bearing cover for the wheel set using the flange [3]. The drive [4] is provided, for example, by a coupling disc that is connected to the wheel axle. Connection to control electronics is necessary for the supply of power and evaluation of the signals.



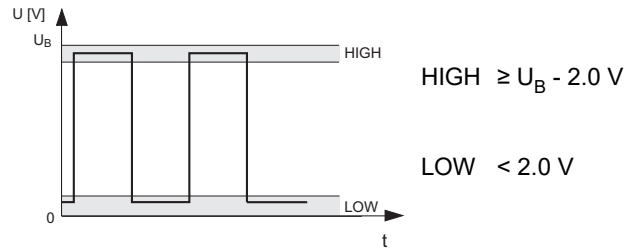
Design of the encoder system

- 1 Basic module: Encoder for Cold Movement Detection (V0)
- 2 Extension: incremental encoder (V1, V2, V3)
- 3 Flange
- 4 Drive (here coupling disc)

The customer-specific designs are marked with a Y number, this number is appended to the product identifier (GEL 2740Yxxx).

Incremental encoder

Inside the magnetic-incremental rotary encoder there is a ferromagnetic measuring scale connected to the axle via the drive. One or more magnetic sensors scan the rotating measuring scale. In this way electrical pulses are generated in the sensors. The integrated electronics convert this information into square-wave voltage signals.



Signal level

The output frequency is proportional to the rotational speed of the axle.

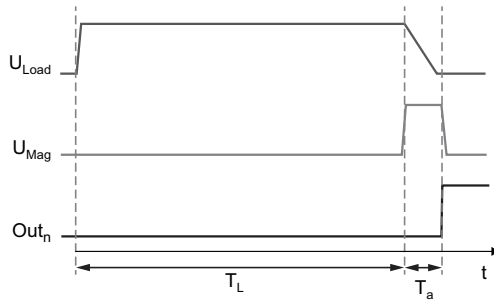
Encoder for Cold Movement Detection

The encoder detects the movement of the wheel axle in the de-energised state and is energy self-sufficient. The sensor consists of four detectors (D1-D4) arranged in a circle and a switching element that rotates with the wheel axle. As the switching element moves past it triggers a state change in the related detector. The current state of the detectors can be read via the outputs (Out1-4) as soon as the encoder is supplied again with power.

To ensure correct function,

- the internal energy store must be sufficiently charged via the input U_{Load} .
- The detectors must be activated by a signal from the control system on the input U_{Mag} .

Charging and activation should take place one after the other.



Timing for charging and activation

T_L Minimum charging time (dependent on the charging voltage)

T_a Activation time (time to switch over the detectors) ≥ 6 ms

Minimum charging time depending on the charging voltage

Charging voltage U_{Load} [V]	10	12	14	16	18	20	22	24	26	28	30
Minimum charging time T_L [ms]	500	270	180	130	110	95	80	70	63	57	52

To charge the energy store, for the time T_L the supply voltage U_B must be present on the input U_{Load} .

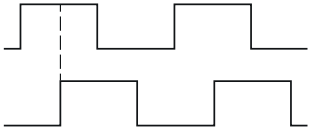
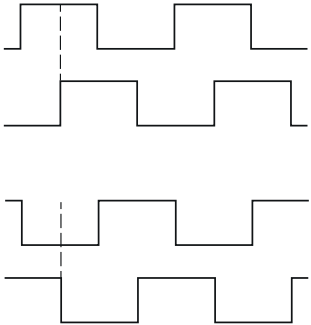
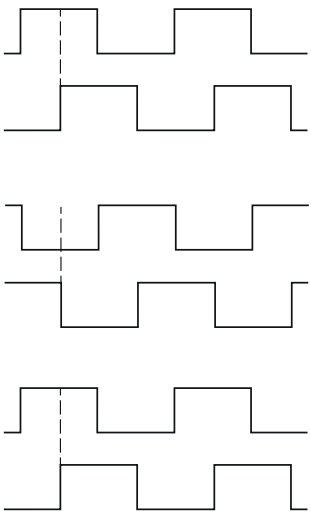
To activate the detectors, U_B must be present for the duration of T_a on the input U_{Mag} . Then the outputs Out_n are switched from level Low to level High. This level corresponds to the state "not moved". If the switching element rotates past a detector, this detector switches to the state "moved".



The "not moved" state is retained for at least 180 days, if it is not reset by a movement of the wheel axle. Here it is a prerequisite that no interfering magnetic fields > 20 kA/m are applied to the housing of the encoder.

Encoder types

Outputs

Encoder type	CMD	Incremental encoder	Pulse diagram for direction of rotation "forward" ⁽¹⁾
2740V0	Out1; Out2; Out3; Out4	–	
2740V1	Out1; Out2; Out3; Out4	2 channels 90° Phase offset	 <p>track 1</p> <p>track 2</p>
2740V2	Out1; Out2; Out3; Out4	2 × 2 channels 90° Phase offset	 <p>track 1</p> <p>track 2</p> <p>track 3</p> <p>track 4</p>
2740V3	Out1; Out2; Out3; Out4	3 × 2 channels 90° Phase offset	 <p>track 1</p> <p>track 2</p> <p>track 3</p> <p>track 4</p> <p>track 5</p> <p>track 6</p>

⁽¹⁾ Other signal patterns upon request

Encoder types

Cable assignment CMD (2740V0)

Function	Core number
U _B	1
GND	2
U _{Load}	3
U _{Mag}	4
Out1	5
Out2	6
Out3	7
Out4	8

Cable assignment, incremental encoder

Function	Core colour		
	2740V1 / 2 channels	2740V2 / 4 channels	2740V3 / 6 channels
System 1			
U _B	red	red	red
GND	blue	blue	blue
track 1	yellow	yellow	yellow
track 2	white	white	white
System 2			
U _B	—	pink	pink
GND	—	grey	grey
track 3	—	green	green
track 4	—	brown	brown
System 3			
U _B	—	—	red-blue
GND	—	—	pink-blue
track 5	—	—	black
track 6	—	—	violet

Technical data

Customer-specific sensor

Sensor system	2740V0	2740V1	2740V2	2740V3
General data				
Measuring systems	CMD	CMD + incremental encoder up to 3 × 2 channels possible		
Incremental encoder	–	2 channels	2 × 2 channels	3 × 2 channels
Output	–	Voltage		
Phase offset	–	90°		
Resolution (number of pulses)	–	80 pulses per revolution ⁽¹⁾		
Mechanical data				
Degree of protection	IP66, IP 67			
Max. permitted rotational speed	5000 min ⁻¹			
Shaft material	Stainless steel			
Housing material	Aluminium, coated			
Weight (not including cable, not including drive)	2000 g	3667 g		
Environmental data				
Operating temperature range	-40 °C to +100 °C			
Storage temperature range	-40 °C to +105 °C			
Vibration resistance	DIN EN 61373:2011-04 cat. 3			
Shock resistance	DIN EN 61373:2011-04 cat. 3			
Electromagnetic compatibility	DIN EN 50121-3-2:2017-11			
Dielectric strength	500 V AC / 750 V DC (DIN EN 50155:2022-06)			
Type test	DIN EN 50155:2022-06			
Max. relative humidity of air	98 %, condensation possible			
Fire protection ⁽²⁾	Hazard level HL2 (R22) / HL3 (R23), as per DIN EN 45545-2:2020-10			
Max. installation altitude above sea level	≤ 2000 m, as per DIN EN 61010-1:2020-03			

⁽¹⁾ Other numbers of pulses upon request

⁽²⁾ depending on the application-specific connector configuration

Technical data – incremental encoder

Electrical data	
Supply voltage U_B (polarity reversal protected)	10 to 30 V DC
Screen connection	Capacitive
Current consumption per channel I_B (without load)	≤ 30 mA
Output signal (short-circuit-proof, push-pull power amplifier)	Square-wave signals
Output frequency	0 to 20 kHz
Output signal level HIGH	$\geq U_B - 2.0$ V
Output signal level LOW	< 2.0 V
Duty	50% \pm 10%
Cable data	
Cable	Halogen-free, screened ⁽¹⁾
Cable diameter	8.0 \pm 0.3 mm
Cable cross section	12 \times 0.34 mm ²
Minimum bending radius, static	120 mm
Cable protection	
Type	Metal protective sleeve
Material	Galvanised steel; Sheath: thermoplastic polyurethane
Outside diameter	21.1 mm
Minimum bending radius, static	120 mm

Technical data – Cold Movement Detection

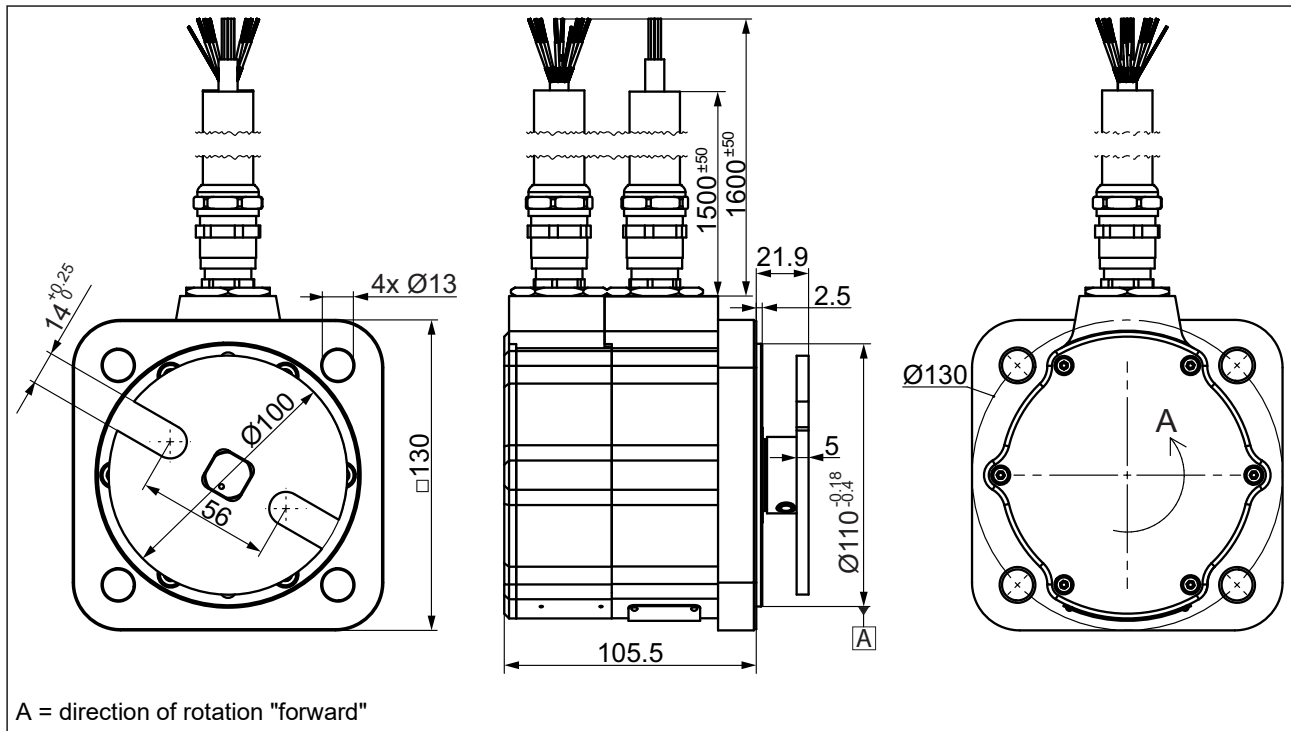
General data	
Outputs	Out1; Out2; Out3; Out4
Inputs	U_{B_Mag} ; U_{B_Load}
Electrical data	
Supply voltage U_B (polarity reversal protected)	10 to 30 V DC
Screen connection	Capacitive
Max. current (at U_{Load})	≤ 180 mA
Current consumption (without load)	in reading mode < 35 mA
Minimum charging time T_L	70 ms (with a charging voltage of 24 V)
Activation time T_a	≥ 6 ms
Output signal level High	$\geq U_B - 2.0$ V
Output signal level Low	≤ 2.0 V
Cable data	
Cable	Halogen-free and screened ⁽¹⁾
Cable diameter	10.5 \pm 0.4 mm
Cable cross-section	8 \times 0.5 mm ²
Minimum bending radius, static	120 mm
Cable protection	
Type	Metal protective sleeve
Material	Galvanised steel; Sheath: thermoplastic polyurethane
Outside diameter	21.1 mm
Minimum bending radius, static	120 mm

⁽¹⁾ Specification upon request

Dimensional drawing, accessories

All dimensions stated in mm, general tolerance DIN ISO 2768 –mK

GEL 2740



Accessories

Item no.	Designation	Mounting information
BG3391	Driver	<p>Ø 60 to Ø 80</p> <p>$\sqrt{\text{Ø 1 A}}$</p> <p>width across flat 8 hexagon socket 25 Nm</p>