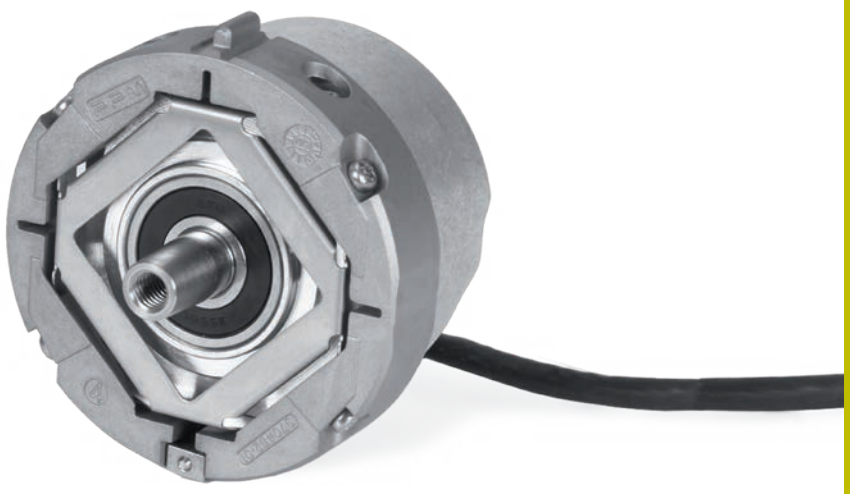
HEIDENHAIN



Functional Safety

Product Information

ECN 425
EQN 437

Absolute Rotary Encoders with Tapered Shaft and Expanding Ring Coupling for Safety-Related Applications

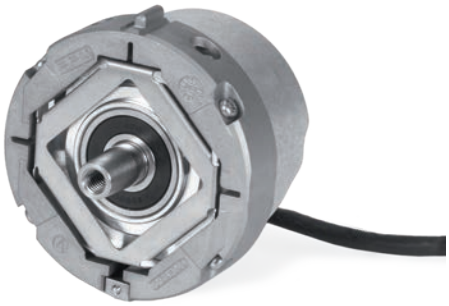
ID 1178028-02
ID 1178029-02

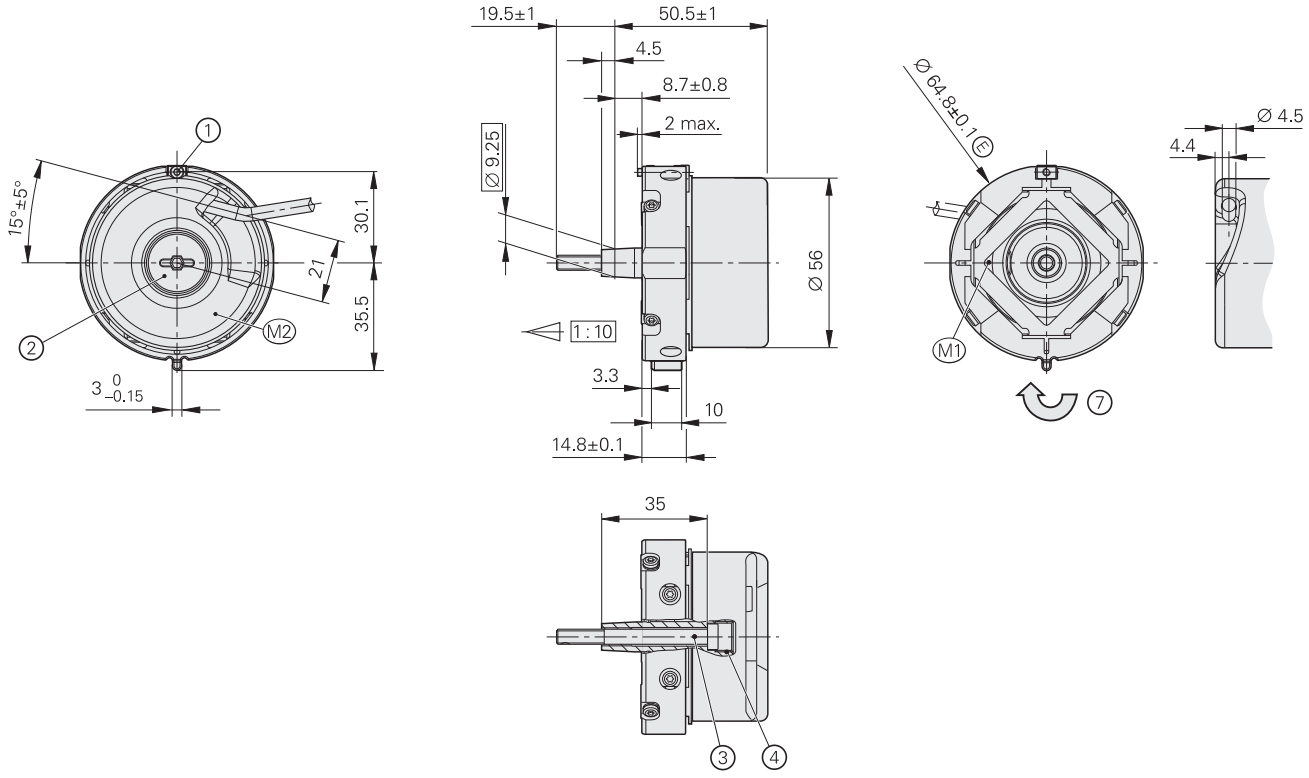
06/2022

ECN 425, EQN 437

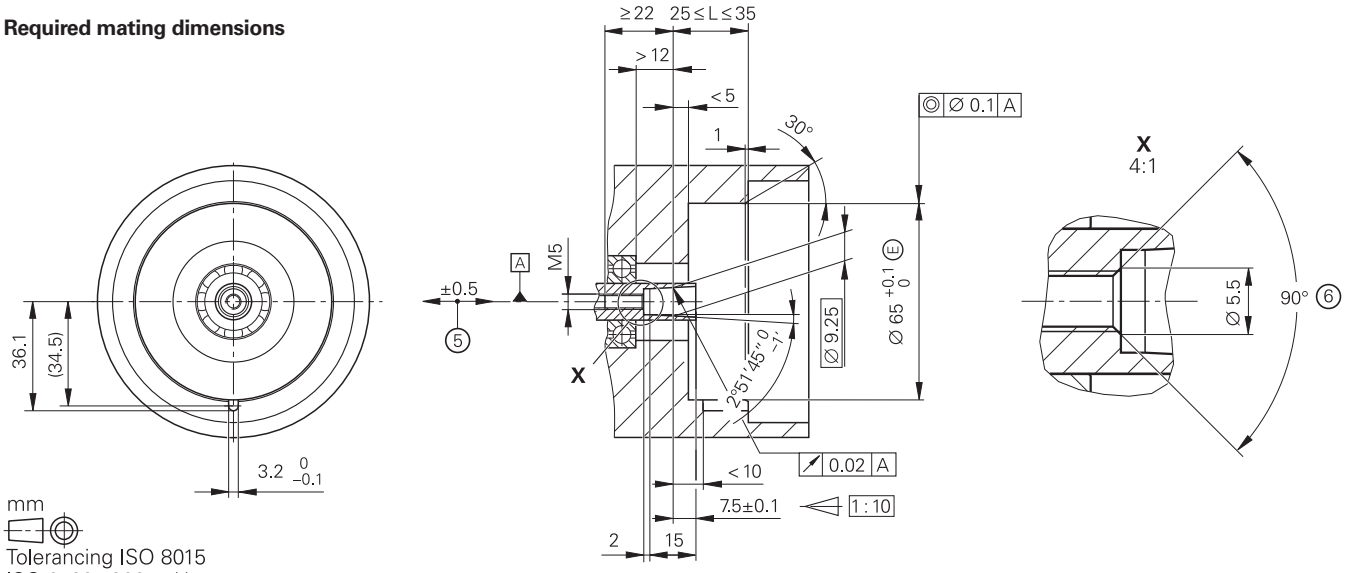
Rotary encoders for absolute position feedback with safe singleturn information

- **65 mm installation diameter**
- **07B expanding ring coupling**
- **65B tapered shaft**
- **IP64 protection**





Required mating dimensions



mm

Tolerancing ISO 8015
ISO 2768:1989-mH
≤ 6 mm: ±0.2 mm

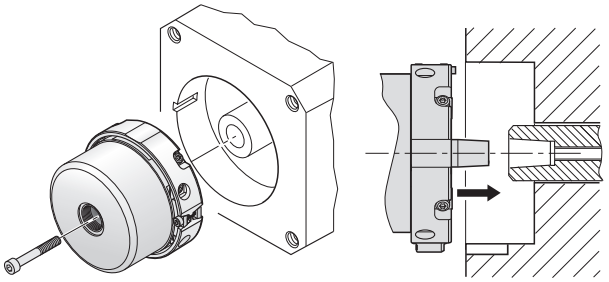
A = Bearing of mating shaft
M1 = Measuring point for operating temperature
M2 = Measuring point for vibration; see D741714
1 = Clamping screw for coupling ring, width A/F 2; tightening torque: 1.25 Nm –0.2 Nm
2 = Screw plug, width A/F 3 and 4; tightening torque: 5 Nm +0.5 Nm
3 = Screw: DIN 6912 – M5x50 – 08.8 – MKL; width A/F 4; tightening torque: 5 Nm +0.5 Nm
4 = M10 back-off thread
5 = Compensation of mounting tolerances and thermal expansion; no dynamic motion permitted
6 = Chamfer at start of thread is obligatory for material bonding anti-rotation lock
7 = Direction of shaft rotation for ascending position values

Specifications	ECN 425 singleturn	EQN 437 multiturn
Functional safety for applications with up to	*As a single-encoder system for monitoring and control-loop functions:* • SIL 2 as per EN 61508 (further basis for testing: IEC 61800-5-3) • Category 3, PL d, according to EN ISO 13849-1:2015 Safe in the singleturn range	
PFH[1]	≤ $10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[2]	*Encoder:* ±1.76° (safety-related measuring step: SM = 0.7°) *Mechanical coupling:* ±2° (exclusion for loosening of shaft and stator coupling, designed for accelerations of ≤ 300 m/s^2)	
Interface/ordering designation	EnDat 2.2/EnDat22	
Position values per revolution	33 554 432 (25 bits)	
Revolutions	–	4096 (12 bits)
Calculation time t_{cal}/clock frequency	≤ 7 µs/≤ 16 MHz	
System accuracy at 20 °C	±20″	
Supply voltage	DC 3.6 V to 14 V	
Power consumption (maximum)	*At 3.6 V:* ≤ 600 mW *At 14 V:* ≤ 700 mW	*At 3.6 V:* ≤ 700 mW *At 14 V:* ≤ 800 mW
Current consumption (typical)	*At 5 V:* 80 mA (without load)	*At 5 V:* 95 mA (without load)
Electrical connection	Cable (1 m) with 8-pin M12 coupling (male)	
Cable length[3]	≤ 100 m (at clock frequency ≤ 8 MHz) ≤ 20 m (at clock frequency ≤ 16 MHz)	
Shaft	65B tapered shaft (Ø 9.25 mm); taper 1:10	
Permissible shaft speed	≤ 15 000 rpm	≤ 12 000 rpm
Starting torque at 20 °C (typical)	≤ 0.01 Nm	
Moment of inertia of rotor	≤ $2.6 \cdot 10^{-6}$ kgm^2	
Angular acceleration of rotor	≤ $1 \cdot 10^5$ rad/s^2	
Natural frequency f_N (typical)	≥ 1800 Hz	
Permiss. axial motion of measured shaft	≤ ±0.5 mm	
Vibration 55 Hz to 2000 Hz[4] **Shock** 6 ms	≤ 300 m/s^2 (EN 60068-2-6) ≤ 2000 m/s^2 (EN 60068-2-27)	
Operating temperature[5]	*Stationary cable:* –40 °C to 100 °C; *Moving cable:* –10 °C to 100 °C	
Trigger threshold for exceeded temperature error message[6]	125 °C (measuring accuracy of the internal temperature sensor: ±1 K)	
Relative humidity	≤ 93% (40 °C/21 d as per EN 60068-2-78), condensation excluded	
Protection rating EN 60529	IP67 on housing; IP64 at shaft inlet (read about insulation under *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochure; contamination from the ingress of fluids must be avoided)	
Mass	≈ 0.3 kg	
ID number	1178028-02	1178029-02

1) For use at ≤ 2000 m above sea level (≤ 6000 m above sea level upon request)
2) Further tolerances may arise in the downstream electronics after position value comparison (contact manufacturer)
3) See the EnDat description in the *Interfaces of HEIDENHAIN Encoders* brochure)
4) 10 Hz to 55 Hz, 4.9 mm constant peak to peak
5) For information on operating temperature, shaft speed, and supply voltage, see *General mechanical information* in the *Rotary Encoders* brochure
6) The internal temperature evaluation is not designed with functional safety

Mounting

The tapered shaft of the rotary encoder is pressed onto the measured shaft and fastened with a central screw. It is particularly important to ensure that the positive-locking element of the stator coupling securely engages the corresponding slot in the measured shaft. Use a central screw with material-bonding anti-rotation lock (see *Mounting accessories*). The stator coupling is clamped by means of an axially tightenable screw in a locating hole.



More information:

For the customer-side mounting design, the material specifications for steel apply to the customer-side shaft. For the customer-side stator, the material specifications for aluminum apply.

Also comply with the other material properties in the *Encoders for Servo Drives* brochure (ID 208922-xx).

Mounting accessories

Screws
Screws (central screw, mounting screws) are not included in delivery and can be ordered separately.

ECN 425, EQN 437 screws[1]			**Quantity**
Central screw for fastening the shaft	DIN 6912 – **M5**×**50** – 08.8 – **MKL**	ID 202264-54	10 or 100

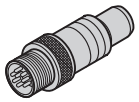
[1] With coating for material bonding anti-rotation lock

For more mounting information and mounting aids, see the mounting instructions and the *Encoders for Servo Drives* brochure. The mounting quality can be inspected with the PWM 21 and ATS software.

Electrical connection

Pin layout

8-pin M12 coupling



	Power supply				Serial data transmission			
	8	**2**	**5**	**1**	**3**	**4**	**7**	**6**
	U_P	Sensor **U_P**	**0 V**	Sensor **0 V**	**DATA**	**$\overline{\text{DATA}}$**	**CLOCK**	**$\overline{\text{CLOCK}}$**
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

Cable shield connected to housing; **U_P** = Power supply voltage
Sensor: The sense line is connected in the encoder with the corresponding power supply line.
Vacant pins or wires must not be used!
Note for safety-related applications: Only completely assembled HEIDENHAIN cables are qualified. Do not modify cables or exchange their connectors without first consulting with HEIDENHAIN Traunreut!

HEIDENHAIN

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This Product Information document supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information document edition valid when the order is placed.

More information:

Comply with the requirements described in the following documents to ensure correct and intended operation:
- Operating Instructions 1379276-xx