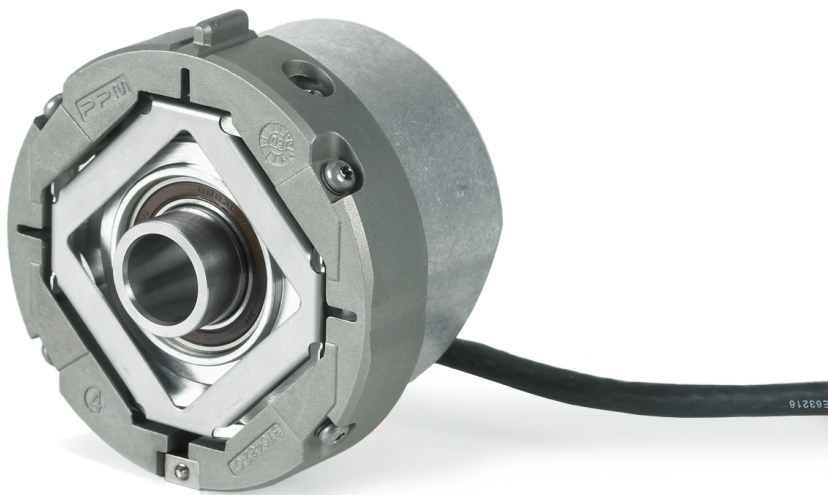




HEIDENHAIN



Product Information

ECN 425 **EQN 437**

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

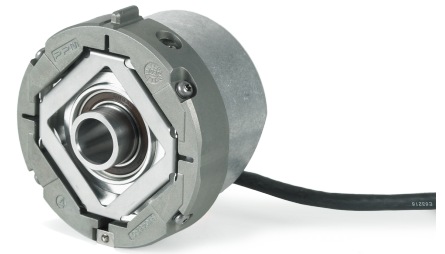
**Functional
Safety**

06/2019

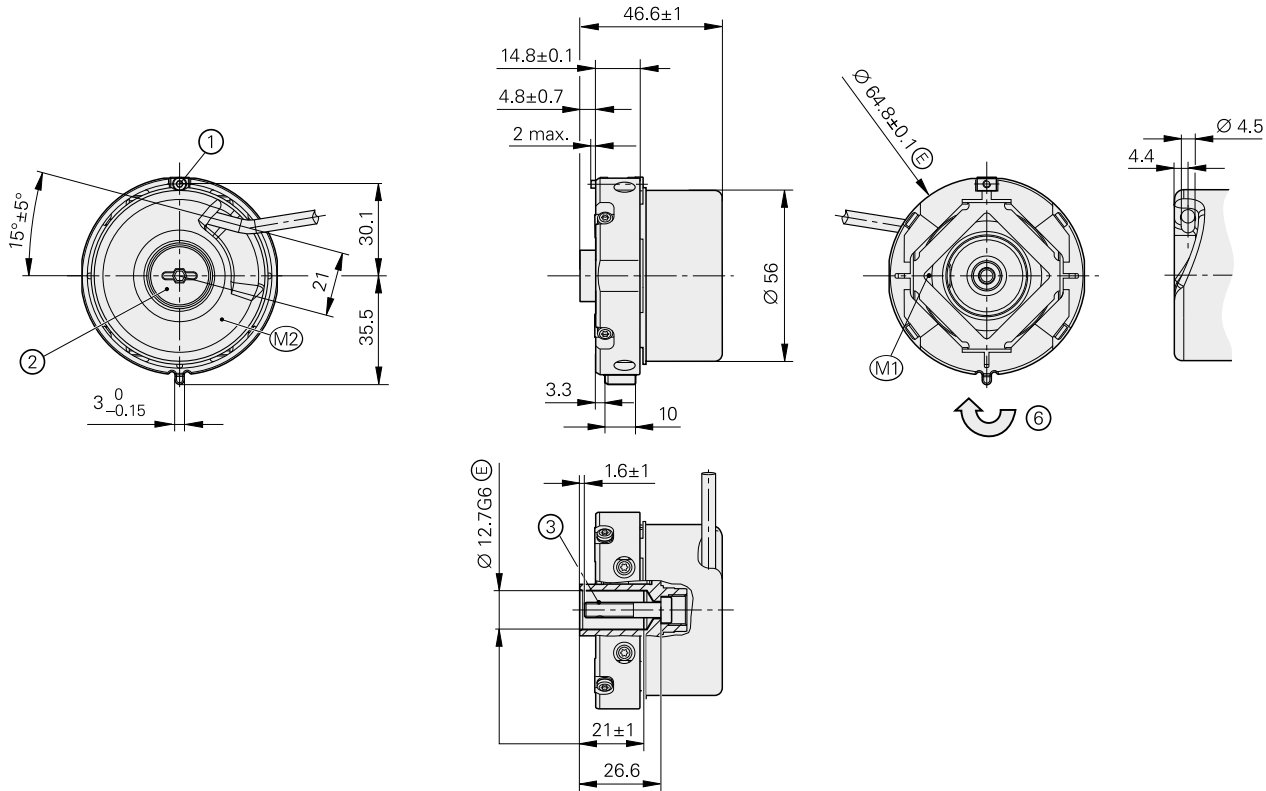
ECN 425, EQN 437

Rotary encoders for absolute position values with safe singleturn information

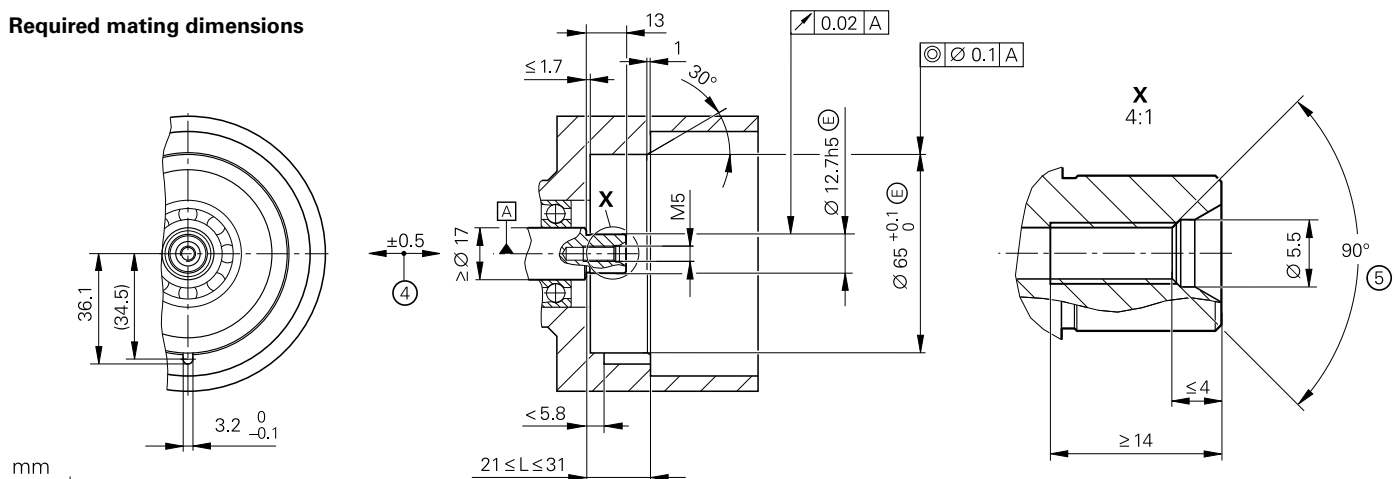
- Installation diameter 65 mm
- 07B Expanding ring coupling
- 67M blind hollow shaft \varnothing 12.7 mm for axial clamping
- IP64 protection



Functional Safety



Required mating dimensions



mm

 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ± 0.2 mm

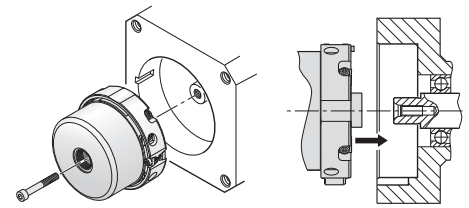
- ☒ = Bearing of mating shaft
- M1= Measuring point for operating temperature
- M2= Measuring point for vibration, see D 741714
- 1 = Clamping screw for coupling ring, width A/F 2, tightening torque: 1.25 Nm -0.2 Nm
- 2 = Screw plug, widths A/F 3 and 4, tightening torque: 5 Nm $+0.5$ Nm
- 3 = Screw DIN 6912 – M5x25 – 08.8 – MKL width A/F 4, tightening torque: 5 Nm $+0.5$ Nm
- 4 = Compensation of mounting tolerances and thermal expansion, no dynamic motion permitted
- 5 = Chamfer at start of thread is obligatory for materially bonding anti-rotation lock
- 6 = Direction of shaft rotation for ascending position values

| Specifications | ECN 425 – singleturn | EQN 437 – multiturn |
|--|---|---|
| Functional safety for applications up to | As single-encoder system for monitoring functions <ul style="list-style-type: none"> • SIL 1 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 2, PL c as per EN ISO 13849-1:2015 As single-encoder system for closed-loop functions <ul style="list-style-type: none"> • SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2015 Safe in the singleturn range | |
| PFH | $\leq 10 \cdot 10^{-9}$ (probability of dangerous failure per hour) | |
| Safe position ¹⁾ | <i>Encoder</i> : $\pm 1.76^\circ$ (safety-related measuring step: SM = 0.7°) <i>mechanical coupling</i> : $\pm 2^\circ$ (fault exclusion for the loosening of the shaft and stator coupling, designed for accelerations $\leq 300 \text{ m/s}^2$) | |
| Interface | EnDat 2.2 | |
| Ordering designation | EnDat22 | |
| Position values per revolution | 33 554 432 (25 bits) | |
| Revolutions | - | 4096 (12 bits) |
| Calculation time t_{cal} Clock frequency | $\leq 7 \mu\text{s}$ $\leq 8 \text{ MHz}$ | |
| System accuracy | $\pm 20''$ | |
| Electrical connection | Cable, 1 m, with 8-pin M12 coupling (male) | |
| Cable length | $\leq 100 \text{ m}$ (see EnDat description in the <i>Interfaces of HEIDENHAIN Encoders</i> brochure) | |
| Supply voltage | DC 3.6 V to 14 V | |
| Power consumption ²⁾ (max.) | At 3.6 V: $\leq 600 \text{ mW}$ At 14 V: $\leq 700 \text{ mW}$ | At 3.6 V: $\leq 700 \text{ mW}$ At 14 V: $\leq 800 \text{ mW}$ |
| Current consumption (typical) | At 5 V: 85 mA (without load) | At 5 V: 105 mA (without load) |
| Shaft | 67M blind hollow shaft for axial clamping $\varnothing 12.7 \text{ mm}$ | |
| Speed | $\leq 12\,000 \text{ rpm}$ | |
| Starting torque at 20 °C (typical) | 0.01 Nm | |
| Moment of inertia of rotor | $3.6 \cdot 10^{-6} \text{ kgm}^2$ | |
| Angular acceleration of rotor | $\leq 5 \cdot 10^4 \text{ rad/s}^2$ | |
| Natural frequency of stator coupling | $\geq 1800 \text{ Hz}$ | |
| Axial motion of measured shaft | $\leq \pm 0.5 \text{ mm}$ | |
| Vibration 55 Hz to 2000 Hz Shock 6 ms | $\leq 300 \text{ m/s}^2$ (EN 60 068-2-6); 10 Hz to 55 Hz constant over distance 4.9 mm peak to peak $\leq 2000 \text{ m/s}^2$ (EN 60 068-2-27) | |
| Min. operating temp. | <i>Stationary cable</i> : $-30 \text{ }^\circ\text{C}$; <i>Moving cable</i> : $-10 \text{ }^\circ\text{C}$ | |
| Max. operating temp. | 100 °C | |
| Trigger threshold of error message for excessive temperature | 125 °C (measuring accuracy of internal temperature sensor: $\pm 4 \text{ K}$) | |
| Relative humidity | $\leq 93 \%$ (40 °C/21 d as per EN 60 068-2-78); without condensation | |
| Protection EN 60529 | IP64 (read about <i>Isolation</i> under <i>General mechanical information</i> in the <i>Encoders for Servo Drives</i> brochure; contamination from the ingress of fluids must be prevented) | |
| Mass | $\approx 0.25 \text{ kg}$ | |
| ID number | ID 678920-01 | ID 678922-01 |

1) Further tolerances may apply in subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
 2) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

Mounting

The shaft of the rotary encoder is slid onto the motor's drive shaft and fastened with a central screw. It must particularly be ensured that the positive-locking element of the stator coupling securely engages the corresponding slot in the measured shaft. A screw with material bonding anti-rotation lock must be used (see *Mounting accessories*). The stator coupling is clamped by means of an axially tightenable screw in a location hole.



Requirements on the motor side for safe mechanical coupling:

| | Mating shaft | Mating stator |
|--|---|--|
| Material | Steel | Aluminum |
| Tensile strength R_m | $\geq 600 \text{ N/mm}^2$ | $\geq 220 \text{ N/mm}^2$ |
| Interface pressure P_G | $\geq 500 \text{ N/mm}^2$ | $\geq 200 \text{ N/mm}^2$ |
| Surface roughness R_z | $\leq 16 \mu\text{m}$ | |
| Coefficient of thermal expansion α_{therm} | $10 \cdot 10^{-6} \text{ K}^{-1}$ to $17 \cdot 10^{-6} \text{ K}^{-1}$ | $\leq 25 \cdot 10^{-6} \text{ K}^{-1}$ |

For the design of the mechanical fault exclusion for the shaft connection, the following maximum torque M_{max} must be considered:

$$M_{\text{max}} = 1.0 \text{ Nm}$$

The customer's mechanical design must ensure that the maximum torque M_{max} occurring in the application can be transmitted.

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-M5×25-08.8-MKL | ID 202264-55 | 10 or 100 |

1) With coating for material-bonding anti-rotation lock

For further mounting information and mounting aids, please refer to the relevant mounting instructions and the *Encoders for Servo Drives* brochure. The mounting can be tested with the PWM 21 and the ATS software.

Electrical connection

Cables with M12 connecting elements

| PUR connecting and adapter cables \varnothing 6 mm; $(4 \times 0.14 \text{ mm}^2) + (4 \times 0.34 \text{ mm}^2)$; $A_P = 2 \times 0.34 \text{ mm}^2$ | | |
|--|---|----------------------------|
| Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male) |  | ID 368330-xx |
| Connecting cable with 8-pin M12 connector (female) and free cable end |  | ID 634265-xx ¹⁾ |
| Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (female) |  | ID 533627-xx |
| Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male) |  | ID 524599-xx |


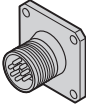
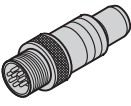



A_P : Cross section of power supply lines

1) Connecting element must be suitable for the maximum clock frequency used

The electromagnetic compatibility of the complete system must be ensured!

Note for safety-related applications: Document the bit error rate in accordance with specification 533095!

Pin layout

| 8-pin M12 coupling | | | | | | | | |
|---|---|--------------|-------------|------------|--|------|---|--------|
|  |  | | | |  | |  | |
| | Power supply | | | | Absolute position values | | | |
|  | 8 | 2 | 5 | 1 | 3 | 4 | 7 | 6 |
| | U_P | Sensor U_P | 0 V | Sensor 0 V | DATA | DATA | CLOCK | CLOCK |
|  | Brown/Green | Blue | White/Green | White | Gray | Pink | Violet | Yellow |

Cable shield connected to housing; **Up** = Power supply

Sensor: The sense line is connected in the encoder with the corresponding power supply.

Vacant pins and 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 made.



Further information: Adhere to the information in the following documents to ensure the correct and intended operation of the encoder:

- Brochure: *Encoders for Servo Drives* 208922-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Mounting Instructions: *ECN 425, EQN 437* 722594-xx
- Technical Information: *Safety-Related Position Measuring Systems* 596632-xx
- Specification: *For implementation in a safe control or inverter* 533095-xx