Product Information

**ECN 425**  
**EQN 437**

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

09/2019
ECN 425, EQN 437

Rotary encoders for absolute position values with safe singleturn information

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

Required mating dimensions

Tolerancing ISO 8015
ISO 2766 - m H
< 6 mm: ± 0.2 mm

1 = 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 – M5x50-08.8 – MKL, width A/F 4, tightening torque: 5 Nm + 0.5 Nm
4 = M10 back-off thread
5 = M6 back-off thread
6 = Compensation of mounting tolerances and thermal expansion; no dynamic motion permitted
7 = Chamfer at start of thread is obligatory for material bonding anti-rotation lock
8 = Direction of shaft rotation for ascending position values
## Specifications

### ECN 425 – Singleturn

**Functional safety**

- As single-encoder system for monitoring functions
  - 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
  - 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 position**

- Encoder: ±1.76° (safety-related measuring step: SM = 0.7°)
- Mechanical coupling: ±2°

**Interface**

- EnDat 2.2

**Ordering designation**

- EnDat22

**Position values per revolution**

- 33 554 432 (25 bits)

**Revolutions**

- 4096 (12 bits)

**Calculation time**

- \( t_{\text{cal}} \leq 7 \mu s \)
- \( f_{\text{clock}} \leq 8 \text{ MHz} \)

**System accuracy**

- ±20" 

**Electrical connection**

- Cable (1 m) with 8-pin M12 coupling (male)

**Supply voltage**

- DC 3.6 V to 14 V

**Power consumption**

- At 3.6 V: \( \leq 600 \text{ mW} \)
- At 14 V: \( \leq 700 \text{ mW} \)

**Current consumption (typical)**

- At 5 V: 85 mA (without load)
- At 5 V: 105 mA (without load)

**Shaft**

- 65B tapered shaft \( \varnothing 9.25 \text{ mm}; \text{ taper } 1:10 \)

**Shaft speed**

- \( \leq 15 000 \text{ rpm} \)
- \( \leq 12 000 \text{ rpm} \)

**Starting torque at 20 °C (typical)**

- 0.01 Nm

**Moment of inertia of rotor**

- \( 2.6 \cdot 10^{-6} \text{ kgm}^2 \)

**Angular acceleration of rotor**

- \( \leq 1 \cdot 10^5 \text{ rad/s}^2 \)

**Natural frequency of stator coupling**

- \( \geq 1800 \text{ Hz} \)

**Axial motion of measured shaft**

- \( \leq 0.5 \text{ mm} \)

**Vibration**

- 55 Hz to 2000 Hz
- \( \leq 300 \text{ m/s}^2 \) (EN 60068-2-6); 10 Hz to 55 Hz constant over 4.9 mm peak to peak

**Min. operating temperature**

- Stationary cable: -40 °C; moving cable: -10 °C

**Max. operating temperature**

- 100 °C

**Trigger threshold**

- of error message for temperature exceedance
- 125 °C (measuring accuracy of the internal temperature sensor: ±4 K)

**Relative humidity**

- \( \leq 93 \% \) (40 °C/21 d as per EN 60068-2-78); without condensation

**Protection class**

- IP64 (read about insulation under *General mechanical information* in the Interfaces of HEIDENHAIN Encoders brochure; contamination from the ingress of liquids must be prevented)

**Mass**

- \( \approx 0.25 \text{ kg} \)

**ID number**

- ID 678920-02
- ID 678922-02

---

1) Further tolerances may arise in subsequent electronics after pos. value comparison (contact manufacturer of subsequent electronics)

2) See *General electrical information* in the Interfaces of HEIDENHAIN Encoders brochure
Mounting

The tapered shaft of the rotary encoder is slid 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 screw with material bonding anti-rotation lock (see Mounting accessories). The stator coupling is clamped by an axially tightened screw in a location hole.

Requirements on the motor side for safe mechanical coupling:

<table>
<thead>
<tr>
<th>Material</th>
<th>Mating shaft</th>
<th>Mating stator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength</td>
<td>≥ 600 N/mm²</td>
<td>≥ 220 N/mm²</td>
</tr>
<tr>
<td>Interface pressure</td>
<td>≥ 500 N/mm²</td>
<td>≥ 200 N/mm²</td>
</tr>
<tr>
<td>Surface roughness</td>
<td>≤ 16 µm</td>
<td></td>
</tr>
<tr>
<td>Coefficient of thermal expansion $\alpha_{\text{therm}}$</td>
<td>10 · 10⁻⁶ K⁻¹ to 17 · 10⁻⁶ K⁻¹</td>
<td>≤ 25 · 10⁻⁶ K⁻¹</td>
</tr>
</tbody>
</table>

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

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

The customer’s mechanical design must ensure that the maximum torque $M_{\text{max}}$ 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.

<table>
<thead>
<tr>
<th>ECN 425, EQN 437</th>
<th>Screws</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central screw</td>
<td>DIN 6912 – M5×50 – 08.8 – MKL</td>
<td>ID 202264-54</td>
</tr>
</tbody>
</table>

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

**Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male)**

<table>
<thead>
<tr>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1036372-xx</td>
</tr>
</tbody>
</table>

**Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (female)**

<table>
<thead>
<tr>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1036521-xx</td>
</tr>
</tbody>
</table>

**Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male)**

<table>
<thead>
<tr>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1036526-xx</td>
</tr>
</tbody>
</table>

**Connecting cable with 8-pin M12 connector (female) and unstripped cable end**

<table>
<thead>
<tr>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1129681-xx</td>
</tr>
</tbody>
</table>

**Aₚ:** Cross section of power supply lines

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

Conformity with the EMC Directive must be ensured for the complete system!

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

**Pin layout**

**8-pin M12 coupling**

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Absolute position values</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Uₚ</td>
<td>Sensor Uₚ</td>
</tr>
<tr>
<td>Brown/Green</td>
<td>Blue</td>
</tr>
</tbody>
</table>

**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.

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH

---

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:** Comply with the requirements described in the following documents to ensure correct operation of the encoder:

- Brochure: *Encoders for Servo Drives* 208922-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Brochure: *Cables and Connectors* 1206103-xx
- Mounting instructions: *ECN 425, EON 437* 727583-xx
- For implementation in a safe control or inverter: Specification 533095-xx