Product Information

ROC 425
ROQ 437
Absolute Rotary Encoders with EnDat 2.2 for Safety-Related Applications

ID 1322270-xx
ID 1322271-xx
ID 1322275-xx
ID 1322276-xx
ROC 425, ROQ 437 with synchro flange

Rotary encoders for absolute position measurement with safe singleturn information

- Rotary encoders for separate shaft coupling
- 01C synchro flange
- 92A solid shaft with flat

Specifications

**Functional safety**
- For monitoring and closed-loop functions in the singleturn range:
  - 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

  PFH\textsuperscript{1)} \(\leq 10^{-10}\) (probability of dangerous failure per hour)

- Safe position\textsuperscript{2)}
  - Encoder: \(\pm 1.76^\circ\) (safety-related measuring step: \(5M = 0.7^\circ\)), mechanical coupling: \(\pm 0^\circ\)
  - Fault exclusion for stator coupling and shaft breakage, designed for accelerations \(\leq 300\, m/s^2\)

**Interface**
- EnDat 2.2

**Ordering designation**
- EnDat22

**Position values per revolution**
- ROC 425: 33 554 432 (25 bits)
- ROQ 437: 4096 (12 bits)

**Calc. time**
- \(t_{calc}/\text{clock freq.} \leq 7\, \mu s / 16\, MHz\)

**System accuracy**
- \(\pm 20^\circ\)

**Electrical connection\textsuperscript{**}
- 8-pin M12 radial\textsuperscript{*} or axial flange socket (male), or 1 m PUR cable with 8-pin M12 coupling (male)

**Cable length\textsuperscript{3)}**
- \(100\, m\) (at clock frequency \(\leq 8\, MHz\))
- \(20\, m\) (at clock frequency \(\leq 16\, MHz\))

**Supply voltage**
- DC 3.6 V to 14 V

**Power consumption\textsuperscript{4)}**
- \(At\ 3.6\, V: 600\, mW;\) \(At\ 14\, V: 700\, mW\)

**Current consumption**
- Typical \(80\, mA\) (without load)

**Shaft**
- 92A solid shaft \(\Phi 6\) mm with flat

**Shaft speed**
- \(15 000\, rpm\)\textsuperscript{5)}
- \(12 000\, rpm\)\textsuperscript{5)}

**Starting torque**
- Typical \(0.01\, Nm\) (at 20 °C)

**Moment of inertia of rotor**
- \(2.9 \times 10^{-6}\, kgm^2\)

**Angular acceleration of rotor**
- \(\leq 1 \times 10^5\, rad/s^2\)

**Shaft load**
- Axial: \(\leq 40\, N\); radial: \(\leq 60\, N\) at shaft end

**Vibration**
- 95 Hz to 2000 Hz

**Shock**
- 6 ms

**Min. operating temp.**
- Flange socket or fixed cable: \(-40\, °C\)
- Moving cable: \(-10\, °C\)

**Max. operating temp.**
- 100 °C

**Trigger threshold\textsuperscript{6)}**
- For exceeded temperature error message

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

**Protection**
- EN 60529
- Housing: IP67; shaft inlet: IP64

**Mass**
- \(\leq 0.3\, kg\)

**ID number**
- 1322270-01*/1322270-02 1322275-01*/1322275-02

\textsuperscript{1) For use at \(\leq 2000\, m\) above sea level (\(\leq 6000\, m\) above sea level upon request)}

\textsuperscript{2) Further tolerances may arise in subsequent electronics after position value comparison (contact mfr. of subsequent electronics)}

\textsuperscript{3) See the EnDat description in the Interfaces of HEIDENHAIN Encoders brochure}

\textsuperscript{4) See General electrical information in the Interfaces of HEIDENHAIN Encoders brochure}

\textsuperscript{5) For the relationship between operating temperature / shaft speed / supply voltage, see General mechanical information in the Rotary Encoders brochure}

\textsuperscript{6) The internal temperature evaluation is not designed for functional safety}
ROC 425, ROQ 437 with clamping flange

 Rotary encoders for absolute position measurement with safe singleturn information

- Rotary encoders for separate shaft coupling
- Ø3C clamping flange
- Ø3D solid shaft with flat

### Specifications

#### Functional safety

For applications with up to:
- 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

PFH1) ≤ 10 · 10⁻⁹ (probability of dangerous failure per hour)

Safe position2) Encoder: ± 1.76° (safety-related measuring step: SM = 0.7°), mechanical coupling: ±0° (fault exclusion for stator coupling and shaft breakage, designed for accelerations ≤ 300 m/s²)

#### Interface

Ordering designation: EnDat 2.2

Position values per revolution: EnDat 2.2

Revolutions: 33 554 432 (25 bits)

Revolutions per clock freq.: ≤ 7 μs / 16 MHz

#### System accuracy

±20°

#### Electrical connection**

- 8-pin M12 radial* or axial flange socket (male), or 1 m PUR cable with 8-pin M12 coupling (male)

Cable length3) ≤ 100 m (at clock frequency ≤ 8 MHz)

#### Supply voltage

DC 3.6 V to 14 V

#### Current consumption (typical)

- 5 V: 80 mA (without load)
- 5 V: 95 mA (without load)

#### Shaft

- Ø3D solid shaft Ø 10 mm with flat
- Shaft speed: ≤ 15 000 rpm
- Starting torque (typical): 0.01 Nm (at 20 °C)
- Moment of inertia of rotor: 2.9 · 10⁻⁶ kgm²
- Angular acceleration of rotor: ≤ 1 · 10⁵ rad/s²
- Shaft load: Axial: ≤ 40 N; radial: ≤ 60 N at shaft end

#### Vibration

55 Hz to 2000 Hz

#### Shock

6 ms ≤ 300 m/s² (EN 60068-2-6); 10 Hz to 55 Hz constant over 4.9 mm peak to peak ≤ 2000 m/s² (EN 60068-2-27)

#### Min. operating temp.

- Flange socket or fixed cable: –40 °C
- Moving cable: –10 °C

#### Max. operating temp.5)

100 °C

#### Trigger threshold of temperature exceedance error message

125 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: ±1 K)

#### Relative humidity

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

#### Protection

EN 60529

#### Mass

≈ 0.3 kg

#### ID number

1322271-01* / 1322272-02 / 1322271-03 / 1322276-01* / 1322276-02

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1) For use at ≤ 2000 m above sea level (≤ 6000 m above sea level upon request)

2) Further tolerances may arise in subsequent electronics after position value comparison (contact mfr. of subsequent electronics)

3) See the EnDat description in the Interfaces of HEIDENHAIN Encoders brochure

4) Please select when ordering

5) For the relationship between operating temperature / shaft speed / supply voltage, see General mechanical information in the Rotary Encoders brochure

6) The internal temperature evaluation is not designed for functional safety

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*This preferred version is available on short notice

** Please select when ordering

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A = Encoder bearing

M1 = Measuring point for operating temperature

M2 = Measuring point for vibration; see also D 341714

1 = M4 – 8.8 screw with material bonding anti-rotation lock; tightening torque: 2.65 Nm ±0.1 Nm; minimum engagement depth: 6 mm

2 = At a permissible interface pressure PG of ≤ 280 N/mm², use a washer

3 = For material properties, see Mounting

4 = Direction of shaft rotation for ascending position values

5 = Connector coding
**Mounting**

The rotary encoders are centered by means of the centering collar of the synchro flange or of the clamping flange and are secured with screws at their front. Mechanical fault exclusion can be ensured only when mounting with three M4 screws of strength class 8.8 and at a minimum engagement depth of 6 mm in the rotary encoder flange. Screws are not included in delivery. The machine designer is responsible for specifying a material bonding anti-rotation lock for the screws depending on the application. Fault exclusion was calculated based on a material bonding anti-rotation lock with a thread friction coefficient of between 0.1 and 0.16. The holes for the screws must be designed in accordance with EN 20273 (medium). The washers must be used for materials with permissible interface pressures of ≤ 280 N/mm².

**Further 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. Note the other material properties in the Rotary Encoders brochure (ID349529-xx).

**Electrical connection**

**Pin layout**

8-pin M12 coupling

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Serial data transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>U_p</td>
<td>Sensor</td>
</tr>
</tbody>
</table>

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 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!

**Further information:**
For mounting information and mounting aids, see the mounting instructions in the Rotary Encoders brochure.