Product Information

ECN 1324 S
EQN 1336 S
Absolute Rotary Encoders with DRIVE-CLiQ Interface for Safety-Related Applications

Firmware 53
ECN 1324 S, EQN 1336 S

Rotary encoders for absolute position values with safe singletum information
- Installation diameter 65 mm
- Expanding ring coupling 07B
- Taper shaft 65B

Required mating dimensions

1. Bearing of mating shaft
2. Measuring point for operating temperature
3. Measuring point for vibration, see D741714
4. Clamping screw for coupling ring width A/F 2, tightening torque 1.25–0.2 Nm
5. Screw plug width A/F 3 and A/F 4, tightening torque 5+0.5 Nm
6. 16-pin header
7. Back-off thread M6
8. Back-off thread M10
9. Compensation of mounting tolerances and thermal expansion, no dynamic motion permitted
10. Chamfer is obligatory at start of thread for materially bonding anti-rotation lock
11. Direction of shaft rotation for output signals as per the interface description

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

### ECN 1324S – Singleturn

<table>
<thead>
<tr>
<th>Part number</th>
<th>1179144-01</th>
</tr>
</thead>
</table>

### EQN 1336S – Multiturn

<table>
<thead>
<tr>
<th>Part number</th>
<th>1179145-01</th>
</tr>
</thead>
</table>

### Functional safety

**For applications up to**

As single-encoder system for monitoring and closed-loop functions

- SIL 2 according to EN 61508 (further basis for testing: EN 61800-5-2)
- Category 3, PL d according to EN ISO 13849-1:2015

**Safe in the singleturn range**

- **PFH**<sup>1</sup> ≤ 27 · 10⁻³ (Probability of dangerous Failure per Hour)
- **Safe position**<sup>2</sup> Encoder: ± 1.76° (safety-related measuring step: SM = 0.7°)  
  Mechanical coupling: ±2° fault exclusion for loosening of shaft and stator coupling, designed for accelerations of ≤ 300 m/s²

### Interface/ordering designation

- DRIVE-CLiQ / DQ01

### Firmware

- Siemens software (version 12.2.2014)
  - SINAMICS, SIMOTION: ≥ V4.4 HF4;  
  - SINUMERIK with safety: ≥ V4.4 SP2;  
  - SINUMERIK without safety: ≥ V4.4 SP1 HF3

### Position values/revolution

- 16777216 (24 bits)

### Revolutions

- 0 – 4096 (12 bits)

### Processing time

- TIME_MAX_ACTVAL ≤ 8 µs
- 4096 (12 bits)

### System accuracy

- ±20”

### Electrical connection

- Encoder PCB connector: 16-pin; with connection for temperature sensor<sup>3</sup>
- Cable length: < 40 m (for the calculation see the brochure Cables and Connectors)
- Voltage supply: DC 24 V (10 V to 28.8 V); up to DC 36.0 V possible without compromising functional safety
- Power consumption<sup>4</sup> (maximum)
  - At 10 V: ≤ 900 mW; at 28.8 V: ≤ 1000 mW
  - At 10 V: ≤ 1000 mW; at 28.8 V: ≤ 1140 mW
- Current consumption (typical)
  - At 24 V: 38 mA (without load)
  - At 24 V: 43 mA (without load)

### Shaft

- Taper shaft Ø 9.25 mm; taper 1:10

### Speed

- ≤ 15 000 rpm (with ≥ 2 position requests/rev)
- ≤ 12 000 rpm (with ≥ 2 position requests/rev)

### Starting torque (at 20 °C)

- ≤ 0.01 Nm

### Moment of inertia of rotor

- 2.6 · 10⁻⁶ kgm²

### Angular acceleration of rotor

- ≤ 1 · 10⁵ rad/s²

### Axial motion of measured shaft

- ≤ ±0.5 mm

### Vibration

- 55 Hz to 2000 Hz
- Shock: 6 ms

### Operating temperature

- –30 °C to 100 °C

### Trigger threshold of error message for excessive temperature

- 117 °C in the scanning ASIC (measuring accuracy of internal temperature sensor: ±2 K at 117 °C)

### Relative humidity

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

### Protection

- EN 60529
  - IP40 (see Insulation under Electrical safety in the brochure Interfaces of HEIDENHAIN Encoders; Contamination by penetrating liquids must be avoided)

### Mass

- ≈ 0.25 kg

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<sup>1</sup> For altitude of ≤ 1000 m above sea level

<sup>2</sup> Further tolerances may occur in subsequent electronics after position value comparison (contact manufacturer of subsequent electronics)

<sup>3</sup> See Temperature measurement in motors in the brochure Encoders for Servo Drives

<sup>4</sup> See General electrical information in the brochure Interfaces of HEIDENHAIN Encoders
ECN 1324 S, EQN 1336 S

Rotary encoders for absolute position values with safe singletum information

- Installation diameter 65 mm
- Expanding ring coupling 07B
- Blind hollow shaft for axial clamping 67M

Required mating dimensions

1. Bearing of mating shaft
2. Measuring point for operating temperature
3. Measuring point for vibration, see D741714
4. Clamping screw for coupling ring width A/F 2, tightening torque 1.25–0.2 Nm
5. Die-cast cover
6. Screw plug width A/F 3 and A/F 4, tightening torque 5+0.5 Nm
7. 16-pin header
8. Screw DIN 6912 – M5x25 – 08.8 – MKL width A/F 4, tightening torque 5+0.5 Nm
9. Compensation of mounting tolerances and thermal expansion, no dynamic movement permitted
10. Chamfer is obligatory at start of thread for materially bonding anti-rotation lock
11. Direction of shaft rotation for output signals as per the interface description

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

<table>
<thead>
<tr>
<th></th>
<th>ECN 1324 S – Singleturn</th>
<th>EQN 1336 S – Multiturn</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID number</strong></td>
<td>1179144-03&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>1179145-02&lt;sup&gt;2)&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Functional safety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For applications up to</td>
<td>As single-encoder system for monitoring and closed-loop functions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• SIL 2 according to EN 61508 (further basis for testing: EN 61800-5-2)</td>
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<td>• Category 3, PL d according to EN ISO 13849-1:2015</td>
<td></td>
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<tr>
<td></td>
<td>Safe in the singleturn range</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>PFH</strong>&lt;sup&gt;1)&lt;/sup&gt; ≤ 27 · 10&lt;sup&gt;−9&lt;/sup&gt; (Probability of dangerous Failure per Hour)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Safe position</strong>&lt;sup&gt;2)&lt;/sup&gt; Encoder: ± 1.76° (safety-related measuring step: SM = 0.7°)</td>
<td>Mechanical coupling: ±2° fault exclusion for loosening of shaft and stator coupling, designed for accelerations of ≤ 300 m/s&lt;sup&gt;2&lt;/sup&gt;)</td>
</tr>
<tr>
<td><strong>Interface/ordering designation</strong></td>
<td>DRIVE-CLiQ / DQ01</td>
<td></td>
</tr>
<tr>
<td><strong>Firmware</strong></td>
<td>01.32.26.53</td>
<td></td>
</tr>
<tr>
<td><strong>Siemens software (version 12.2.2014)</strong></td>
<td>SINAMICS, SIMOTION: ≥ V4.4 HF4; SINUMERIK with safety: ≥ V4.4 SP2; SINUMERIK without safety: ≥ V4.4 SP1 HF3</td>
<td></td>
</tr>
<tr>
<td><strong>Position values/revolution</strong></td>
<td>16777216 (24 bits)</td>
<td></td>
</tr>
<tr>
<td><strong>Revolutions</strong></td>
<td>–</td>
<td>4096 (12 bits)</td>
</tr>
<tr>
<td><strong>Processing time</strong></td>
<td>TIME_MAX_ACTVAL ≤ 8 µs</td>
<td></td>
</tr>
<tr>
<td><strong>System accuracy</strong></td>
<td>±20°</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical connection</strong></td>
<td>Encoder PCB connector: 16-pin; with connection for temperature sensor&lt;sup&gt;3)&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>&lt; 40 m (for the calculation see the brochure Cables and Connectors)</td>
<td></td>
</tr>
<tr>
<td><strong>Voltage supply</strong></td>
<td>DC 24 V (10 V to 28.8 V); up to DC 36.0 V possible without compromising functional safety</td>
<td></td>
</tr>
<tr>
<td><strong>Power consumption</strong>&lt;sup&gt;4)&lt;/sup&gt; (maximum)</td>
<td>At 10 V: ≤ 900 mW; at 28.8 V: ≤ 1000 mW</td>
<td>At 10 V: ≤ 1000 mW; at 28.8 V: ≤ 1140 mW</td>
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<tr>
<td><strong>Current consumption</strong>&lt;sup&gt;4)&lt;/sup&gt; (typical)</td>
<td>At 24 V: 38 mA (without load)</td>
<td>At 24 V: 43 mA (without load)</td>
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<tr>
<td><strong>Shaft</strong></td>
<td>Blind hollow shaft for axial clamping Ø 12.7 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>≤ 12 000 rpm (with ≥ 2 position requests/rev)</td>
<td></td>
</tr>
<tr>
<td><strong>Starting torque</strong></td>
<td>(at 20 °C) ≤ 0.01 Nm</td>
<td></td>
</tr>
<tr>
<td><strong>Moment of inertia of rotor</strong></td>
<td>3.4 · 10&lt;sup&gt;−6&lt;/sup&gt; kgm&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Angular acceleration of rotor</strong></td>
<td>≤ 5 · 10&lt;sup&gt;4&lt;/sup&gt; rad/s&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Axial motion of measured shaft</strong></td>
<td>≤ ±0.5 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Vibration</strong>&lt;sup&gt;5)&lt;/sup&gt; 55 Hz to 2000 Hz</td>
<td>≤ 300 m/s&lt;sup&gt;2&lt;/sup&gt; (EN 60068-2-6); 10 Hz to 55 Hz constant over 4.9 mm peak to peak ≤ 2000 m/s&lt;sup&gt;2&lt;/sup&gt; (EN 60068-2-27)</td>
<td></td>
</tr>
<tr>
<td><strong>Shock</strong></td>
<td>6 ms</td>
<td>300 m/s&lt;sup&gt;2&lt;/sup&gt; (EN 60068-2-27)</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>−30 °C to 100 °C</td>
<td></td>
</tr>
<tr>
<td><strong>Trigger threshold</strong> of error message for excessive temperature</td>
<td>117 °C in the scanning ASIC (measuring accuracy of internal temperature sensor: ±2 K at 117 °C)</td>
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<td><strong>Relative humidity</strong></td>
<td>≤ 93 % (40 °C/21 d as per EN 60068-2-78); without condensation</td>
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</tr>
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<td><strong>Protection</strong></td>
<td>EN 60529</td>
<td>IP40 (see Insulation under Electrical safety in the brochure Interfaces of HEIDENHAIN Encoders; Contamination by penetrating liquids must be avoided)</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>≈ 0.25 kg</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1)</sup> For altitude of ≤ 1000 m above sea level
<sup>2)</sup> Further tolerances may occur in subsequent electronics after position value comparison (contact manufacturer of subsequent electronics)
<sup>3)</sup> See Temperature measurement in motors in the brochure Encoders for Servo Drives
<sup>4)</sup> See General electrical information in the brochure Interfaces of HEIDENHAIN Encoders
<sup>5)</sup> Upon request
Mounting

The shaft of the rotary encoder is slid onto the motor’s drive 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 mating part. Use a central screw with material-bonding anti-rotation lock (see Mounting accessories). The stator coupling is clamped by an axially tightened screw in a location bore.

Conditions required on the motor side for a safe mechanical connection:

<table>
<thead>
<tr>
<th>Material</th>
<th>Mating shaft</th>
<th>Mating stator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Steel</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Tensile strength $R_m$</td>
<td>$\geq 600 \text{ N/mm}^2$</td>
<td>$\geq 220 \text{ N/mm}^2$</td>
</tr>
<tr>
<td>Interface pressure $P_G$</td>
<td>$\geq 500 \text{ N/mm}^2$</td>
<td>$\geq 200 \text{ N/mm}^2$</td>
</tr>
<tr>
<td>Surface roughness $R_z$</td>
<td>$\leq 16 \mu m$</td>
<td></td>
</tr>
<tr>
<td>Coefficient of thermal expansion $\alpha_{\text{therm}}$</td>
<td>$(10 \text{ to } 17) \cdot 10^{-6} \text{ K}^{-1}$</td>
<td>$\leq 25 \cdot 10^{-6} \text{ K}^{-1}$</td>
</tr>
</tbody>
</table>

The following maximum torque $M_{\text{max}}$ has to be considered when designing the mechanical fault exclusion for the shaft connection: $M_{\text{max}} = 1.0 \text{ Nm}$

Mounting accessories

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

<table>
<thead>
<tr>
<th>ECN 1324 S, EQN 1336 S</th>
<th>Central screws for fastening the shaft</th>
<th>Lot size</th>
</tr>
</thead>
<tbody>
<tr>
<td>For tapered shaft 65B</td>
<td>DIN 6912-\text{M5x50-08.8-MKL}</td>
<td>ID 202264-54 10 or 100 pieces</td>
</tr>
<tr>
<td>For hollow shaft 67M</td>
<td>DIN 6912-\text{M5x25-08.8-MKL}</td>
<td>ID 202264-55</td>
</tr>
</tbody>
</table>

$^1$ With coating for materially bonding anti-rotation lock

Please note the information on screws from HEIDENHAIN in the catalog titled Encoders for Servo Drives, chapter General mechanical information under Rotary encoders with functional safety.

Mounting aid
The mounting aid serves to plug and unplug the PCB connector. It prevents damage to the cable because the strain is applied only to the connector. The wires must not be pulled.

ID 1075573-01

For further mounting information and mounting aids, refer to the Encoders for Servo Drives catalog.
Integrated temperature evaluation

These rotary encoders feature an internal temperature sensor integrated in the encoder electronics as well as an evaluation circuit for an external temperature sensor. In both cases, the respective digitized temperature value is transmitted purely serially via the DRIVE-CLiQ interface. Note that temperature measurement and transmission are not secure in the sense of functional safety.

The temperature measured by the internal temperature sensor is higher by a devicespecific and application-specific amount than the temperature at the measuring point M1 in accordance with the dimension drawing.

When the trigger threshold is exceeded for the internal temperature, the encoders issue the error message “Alarm 405.” This threshold depends on the encoder model and is shown in the specifications. Keeping a sufficient distance from the error-message threshold is recommended during operation.

The encoder’s intended use requires compliance with the operating temperature at the measuring point M1.

Temperature measurement

Temperature measurement in motors

In order to protect a motor from an excessive load, the motor manufacturer usually installs a temperature sensor near the motor coil.

The PT 1000 or alternatively the semiconductor sensor KTY 84-130 is to be used. The following values for the accuracy of the evaluation circuit apply to the PT 1000:

- ±4 K at 80 °C to 160 °C
- ±6 K at -40 °C to 80 °C and 160 °C to 200 °C

The following values for the accuracy of the evaluation circuit apply to the KTY 84-130 semiconductor sensor:

- ±2 K at 80 °C to 160 °C
- ±6 K at -40 °C to 80 °C and 160 °C to 200 °C

The temperature values are transmitted via the DRIVE-CLiQ protocol.

The temperature sensor used is adjustable via parameter 601 in the configuration software (e.g., starter) of the drive.

DRIVE-CLiQ is a registered trademark of SIEMENS AG.
Electrical requirements

Switch-on and switch-off conditions

- **Operation**: Switch-off
- **Off**: Switch-on
- **Start-up**: Ready for operation

**U_{off} < 2 V**
- 36 V (without compromising functional safety)
- Typically 15 s
- 28.8 V
- U_{p min.}

**U_{p}** (at the encoder)

- dU_{df} < -50 V/s
- dU_{df} > 50 V/s

min. 100 ms

U_{off} < 2 V
**Electrical connection**

### Cables

<table>
<thead>
<tr>
<th>EPG cables inside the motor housing</th>
<th>ID</th>
<th>Note for safety-related applications: CE compliance of the complete system must be documented!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 3.7 mm; [(2 x 2 x 0.06) + (4 x 0.06)] mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with PCB connector, 16-pin and SpeedTEC M23 right-angle socket (male), 9-pin; with wires for temperature sensor</td>
<td>ID 1120945-xx</td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with PCB connector, 16-pin and M12 flange socket (male), 8-pin; with wires for temperature sensors</td>
<td>ID 1181373-xx</td>
<td></td>
</tr>
<tr>
<td>Complete with PCB connector, 16-pin and M12 flange socket (male), 8-pin; with wires for temperature sensors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Note for safety-related applications: CE compliance of the complete system must be documented!

<table>
<thead>
<tr>
<th>PUR connecting cable</th>
<th>ID</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø 6.8 m; [(2 x 2 x 0.17 mm²) + (2 x 0.24 mm²)]; Aₚ = 0.24 mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with SpeedTEC M23 connector (female) and RJ45 Siemens connector (IP20)</td>
<td>ID 1121546-xx</td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with SpeedTEC M23 connector (female) and coupling M12 (male), 8-pin</td>
<td>ID 1121536-xx</td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with M12 connector (female) and M12 coupling (male), 8-pin</td>
<td>ID 822504-xx</td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with M12 connector (female), 8-pin, and RJ45 Siemens connector (IP67)</td>
<td>ID 1094652-xx</td>
<td></td>
</tr>
<tr>
<td><strong>Complete</strong> with M12 connector (female), 8-pin, and RJ45 Siemens connector (IP20)</td>
<td>ID 1093042xx</td>
<td></td>
</tr>
</tbody>
</table>

Aₚ: Cross section of power supply lines

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SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.
Electrical connection

Pin layout

M12 flange socket, 8-pin

M23 SpeedTEC angle flange socket, 9-pin

PCB connector, 16-pin

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Serial data transfer</th>
<th>Other signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12</td>
<td>8 2 1 5 3 4 7 6</td>
<td>/ /</td>
</tr>
<tr>
<td>M23</td>
<td>3 7 8 4 5 6 1 2</td>
<td>/ /</td>
</tr>
<tr>
<td>16</td>
<td>1b 6a 3a 4b 6b 1a 2b 5a 8a 8b</td>
<td>/ /</td>
</tr>
</tbody>
</table>

Cable shield connected to housing; U_P = voltage supply
Vacant pins or wires must not be used!

Encoder cables with a cable length > 0.5 m require strain relief of the cable
1) Only for output cables inside the motor housing
2) Connections for external temperature sensor, evaluation optimized for KTY 84-130/PT 1000 (see Temperature measurement in motors in the brochure Position Encoders for Servo Drives)

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

For more information:

This Product Information 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.

- Interfaces of HEIDENHAIN Encoders brochure: 1078628
- Mounting Instructions: ECN 1324 S, EQN 1336 S: 1038275
- Brochure: Cables and Connectors: 1206103