Product Information

KCI 1319
KBI 1335
Absolute Inductive Rotary Encoders without Integral Bearing

With additional measures suitable for safety-related applications with up to SIL3
KCI 1319, KBI 1335

Rotary encoders for absolute position values
- Robust inductive scanning principle
- Consisting of a scanning unit and a rotor unit

All drawings are shown with brakes released

Tolerancing ISO 9015
ISO 2768 - HI
< 6 mm: ±0.2 mm

Table: Total height Tolerance

<table>
<thead>
<tr>
<th>Total height</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.8</td>
<td>± 1.2</td>
</tr>
<tr>
<td>14.8</td>
<td>± 2.0</td>
</tr>
</tbody>
</table>

Rotor fastening via three axial countersunk head screws

Rotor fastening via press-fitted hub

Steel

Aluminum

Rotor fastening via press-fitted hub

All dimensions are shown with brakes released.
Specifications KCI 1319 singleturn KBI 1335 multiturn

Functional safety for applications with up to
- SIL 2, as per EN 61508 (further basis for testing: IEC 61800-6-2)
- Category 3, PL d, in accordance with EN ISO 13849-1:2019
With additional measures as per document 1000344, suitable for safety-related applications with up to
SIL 3 or Category 4, PL e
Safe in the singleturn range

Specifications

PhH1)  
SIL 2: \( p \leq 15 \cdot 10^{-9} \) (probability of dangerous failure per hour)  
SIL 3: \( p \leq 2 \cdot 10^{-9} \)

Safe position1)  
Encoder: \( \pm 0.88^\circ \) (safety-related measuring step SM \( = 0.35^\circ \))

Mechanical coupling: 0° fault exclusion for the loosening of the shaft coupling and stator coupling, designed for accelerations on the stator: \( \leq 400 \text{ m/s}^2 \), on the rotor: \( \leq 600 \text{ m/s}^2 \)

Interface
EnDat 2.2

Ordering designation  
EnDat22

Position values per revolution  
524,288 (19 bits)

Revolutions
- 65,536 (16 bits)

Calculation time \( t_{\text{calc}} \)
\( \leq 5 \mu s \)

Clock frequency
\( \leq 16 \text{ MHz} \)

System accuracy
\( \pm 90^\circ \)

Electrical connection
18-pin PCB connector (with connection for external temperature sensor)

Cable length
\( \leq 100 \text{ m} \)

Supply voltage  
DC 3.6 V to 14 V
Rotary encoder Uic: DC 3.6 V to 14 V
Backup battery \( U_{\text{bat}} \): DC 3.6 V to 5.25 V

Power consumption (maximum)  
At 3.6 V: \( \leq 650 \text{ mW} \)  
At 14 V: \( \leq 700 \text{ mW} \)

Current consumption (typical)  
At 3.6 V: \( \leq 95 \mu A \) (without load)  
Normal operation at 5 V: \( \leq 95 \mu A \) (without load)  
Backup battery: \( 200 \mu A \) (rotating shaft)\(^2\)  
20 \( \mu A \) (at standstill)

Part number
AE KCI 1319 scanning unit  
1314405-01  
Circular scale (screw-fastened version)  
1314410-01  
Disk/hub assembly (press-fitted version)  
1314409-01

AE KBI 1335 scanning unit  
1314406-01  
Circular scale (screw-fastened version)  
1314410-01  
Disk/hub assembly (press-fitted version)  
1314409-01

1) For use at \( \leq 1000 \text{ m above sea level} \) (\( \leq 6000 \text{ m above sea level upon request} \)

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

3) See General electrical information in the Interfaces of HEIDENHAIN Encoders brochure or at www.heidenhain.com

4) At \( T = 25^\circ \text{C}; U_{\text{bat}} = 3.6 \text{V} \)

 Specifications KCI 1319 singleturn KBI 1335 multiturn

Rotor\(^1\)  
Circular scale with inside hub diameter of 25 mm (screw-fastened version)  
Circular scale with circular hole pattern diameter of 30.5 mm (screw-fastened version)

Shaft speed  
\( \leq 10,000 \text{ rpm} \)

Moment of inertia
- Disk/hub assembly: \( 6.3 \cdot 10^{-6} \text{ kgm}^2 \)  
- Circular scale: \( 1.16 \cdot 10^{-6} \text{ kgm}^2 \)

Angular acceleration of rotor\(^1\)  
\( \leq 1 \cdot 10^5 \text{ rad/s}^2 \)

Axial motion of measured shaft
\( \leq 0.5 \text{ mm} \)

Vibration
S5 Hz to 2000 Hz\(^2\)

Shock
6 ms

Operating temperature
\( -40 \text{ °C} \) to \( 115 \text{ °C} \)

Trigger threshold for exceeded temperature error message  
130 °C (measuring accuracy of internal temperature sensor: \( \pm 1 \text{ K} \))

Relative humidity
\( \leq 93\% \) (40 °C/21 d as per EN 60068-2-78), condensation excluded

Protection rating
EN 60529 IP00 (read about insulation under General electrical information in the Encoders for Servo Drives brochure)

Mass
AE + TK: 0.03 kg  
AE + TKN: 0.05 kg

<table>
<thead>
<tr>
<th>Specifications</th>
<th>KCI 1319 singleturn</th>
<th>KBI 1335 multiturn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional safety for applications with up to</td>
<td>As a single-encoder system for monitoring functions and control-loop functions:</td>
<td>Circular scale with inside hub diameter of 25 mm (screw-fastened version)</td>
</tr>
<tr>
<td></td>
<td>• SIL 2, as per EN 61508 (further basis for testing: IEC 61800-6-2)</td>
<td>Circular scale with circular hole pattern diameter of 30.5 mm (screw-fastened version)</td>
</tr>
<tr>
<td></td>
<td>• Category 3, PL d, in accordance with EN ISO 13849-1:2019</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With additional measures as per document 1000344, suitable for safety-related applications with up to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIL 3 or Category 4, PL e</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safe in the singleturn range</td>
<td></td>
</tr>
<tr>
<td>Specifications</td>
<td>KCI 1319 singleturn</td>
<td>KBI 1335 multiturn</td>
</tr>
<tr>
<td>Interface</td>
<td>EnDat 2.2</td>
<td></td>
</tr>
<tr>
<td>Ordering designation</td>
<td>EnDat22</td>
<td></td>
</tr>
<tr>
<td>Position values per revolution</td>
<td>524,288 (19 bits)</td>
<td></td>
</tr>
<tr>
<td>Revolutions</td>
<td>–</td>
<td>65,536 (16 bits)</td>
</tr>
<tr>
<td>Calculation time ( t_{\text{calc}} )</td>
<td>( \leq 5 \mu s )</td>
<td></td>
</tr>
<tr>
<td>Clock frequency</td>
<td>( \leq 16 \text{ MHz} )</td>
<td></td>
</tr>
<tr>
<td>System accuracy</td>
<td>( \pm 90^\circ )</td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td>18-pin PCB connector (with connection for external temperature sensor)</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>( \leq 100 \text{ m} ) (see the EnDat description in the Interfaces of HEIDENHAIN Encoders brochure)</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>DC 3.6 V to 14 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rotary encoder Uic: DC 3.6 V to 14 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Backup battery ( U_{\text{bat}} ): DC 3.6 V to 5.25 V</td>
<td></td>
</tr>
<tr>
<td>Power consumption (maximum)</td>
<td>At 3.6 V: ( \leq 650 \text{ mW} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At 14 V: ( \leq 700 \text{ mW} )</td>
<td></td>
</tr>
<tr>
<td>Current consumption (typical)</td>
<td>At 3.6 V: ( \leq 95 \mu A ) (without load)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal operation at 5 V: ( \leq 95 \mu A ) (without load)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Backup battery: ( 200 \mu A ) (rotating shaft)(^2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 ( \mu A ) (at standstill)</td>
<td></td>
</tr>
<tr>
<td>Part number</td>
<td>AE KCI 1319 scanning unit 1314405-01</td>
<td>AE KBI 1335 scanning unit 1314406-01</td>
</tr>
<tr>
<td></td>
<td>Circular scale (screw-fastened version) 1314410-01</td>
<td>Circular scale (screw-fastened version) 1314410-01</td>
</tr>
<tr>
<td></td>
<td>Disk/hub assembly (press-fitted version) 1314409-01</td>
<td>Disk/hub assembly (press-fitted version) 1314409-01</td>
</tr>
</tbody>
</table>

1) Please select when ordering
2) With multiturn functionality in normal operation; maximum permissible acceleration in backup-battery mode upon request
3) 10 Hz to 55 Hz, constant over 6.5 mm peak to peak (stator), 10 mm peak to peak (rotor)
4) At \( T = 25^\circ \text{C}; U_{\text{bat}} = 3.6 \text{V} \)
The KCI 1319/KBI 1335 is mounted either via screw-fastening of the circular scale or through press-fitting of the disk/hub assembly, followed by mounting of the scanning unit. The disk/hub assembly is thereby either press-fitted onto the shaft, or the circular scale is screw-fastened to the given shaft with three screws. The scanning unit is aligned and mounted via four holes on the customer’s mounting surface.

The press-fitting process may be performed only once for each disk/hub assembly. For press-fitting, adhere to the material properties and conditions for the mating surface stated in the relevant documents for proper use. These requirements must be followed, even when new disk/hub assemblies are press-fitted onto customer shafts that have already been used. Once the lower limit of the press-fit force has been exceeded, the press-fit force being applied must remain within the specified range for the rest of the procedure, including until the final position is reached.

The following material properties and conditions must be complied with for the customer-side mounting design:

<table>
<thead>
<tr>
<th>Material</th>
<th>Mating stator</th>
<th>Mating shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>Steel</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Tensile strength (R_m)</td>
<td>(\geq 220 \text{ N/mm}^2)</td>
<td>(\geq 220 \text{ N/mm}^2)</td>
</tr>
<tr>
<td>Yield strength (R_{0.2}) or yield point (R_	ext{p}^0)</td>
<td>(\geq 400 \text{ N/mm}^2)</td>
<td>Not available</td>
</tr>
<tr>
<td>Shear strength (t_m)</td>
<td>(\geq 130 \text{ N/mm}^2)</td>
<td>(\geq 130 \text{ N/mm}^2)</td>
</tr>
<tr>
<td>Interface pressure (P_I)</td>
<td>(\geq 250 \text{ N/mm}^2)</td>
<td>(\geq 250 \text{ N/mm}^2)</td>
</tr>
<tr>
<td>Modulus of elasticity (E) (at 20 °C)</td>
<td>70 kN/mm² to 75 kN/mm²</td>
<td>200 kN/mm² to 215 kN/mm²</td>
</tr>
</tbody>
</table>
| Coefficient of thermal expansion \(a_{\text{temp}}\) (at 20 °C) | \(\leq 25 \cdot 10^{-6} \text{ K}^{-1}\) | Screw-fastened version: \(10^{-6} \text{ K}^{-1}\) to 
17 \(\cdot 10^{-6} \text{ K}^{-1}\) |
| Surface roughness \(R_z\) | \(\leq 16 \mu m\) | Screw-fastened version: \(10^{-6} \text{ K}^{-1}\) to 
12 \(\cdot 10^{-6} \text{ K}^{-1}\) |

**Mounting accessories**

**Screws**  
Screws (fastening screws) are not included in delivery; the M3×10 screw with material bonding anti-rotation lock can be ordered separately.

<table>
<thead>
<tr>
<th>KCI 1319</th>
<th>Screws</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>KBI 1335</td>
<td>Screw for fastening the scanning unit</td>
<td>ISO 4762 – M3x10 – 8.8 – MKL</td>
</tr>
<tr>
<td></td>
<td>Fastening screw for circular scale with a steel mating shaft</td>
<td>ISO 14581 – M2x6 – A2 – 70</td>
</tr>
<tr>
<td></td>
<td>Fastening screw for circular scale with an aluminum mating shaft</td>
<td>ISO 14581 – M2x8 – A2 – 70</td>
</tr>
</tbody>
</table>

1) With coating for material bonding anti-rotation lock (for information on use, see the Encoders for Servo Drives brochure)  
2) Without anti-rotation lock; use at least a medium-strength material bonding anti-rotation lock

**Mounting aid**  
To avoid damage to the cable, use the mounting aid to connect and disconnect the cable assembly. Apply pulling force only to the connector of the cable assembly and not to the wires.

ID 1075573-01

For more mounting information and mounting aids, see the Mounting Instructions and the Encoders for Servo Drives brochure. The installation can be inspected with the PWM 21 and the ATS software (see document 1082415).
Electrical connection

Cables

Output cables inside the motor housing with TPE single wires (8 × 0.16 mm²) and net sleeve without shield

Output cable with 15-pin PCB connector and 8-pin M12 straight flange socket (male) with TPE single wires for temperature sensor (2 × 0.16 mm²)

Output cable with 15-pin PCB connector and 8-pin M12 straight flange socket (male)

Output cable with 15-pin PCB connector and TPE single wires for temperature sensor (2 × 0.16 mm²), and stripped cable end

Output cable inside the motor housing with TPE single wires (8 × 0.16 mm²) and heat shrink tubing without a shield

Output cable with 15-pin PCB connector and stripped cable end

Output cable for HMC 6: Ø 3.7 mm EPG 1 × (4 × 0.06 mm²) + 4 × 0.06 mm²

Pin layout for KCI 1319

8-pin M12 coupling or flange socket

15-pin PCB connector

ID 1119952-xx

ID 804201-xx

ID 1119956-xx

ID 640555-xx

ID 1072652-xx

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

Pin layout for KBI 1335

8-pin M12 flange socket

15-pin PCB connector

Power supply
Serial data transmission
Other signals

8 2 5 1 3 4 7 6 /

13 11 14 12 7 8 9 10 5 6

Uᵢₚ Sensor 0 V Sensor 0 V

DATA DATA CLOCK CLOCK T+ T–

Brown/ Green Blue White/ Green White Gray Pink Violet Yellow Brown Green

Further information:

For connecting cables and adapter cables, see the Cables and Connectors brochure.

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 1357580
- Technical Information Safety-Related Position Measuring Systems 596632-xx
- Implementation in a safe control or inverter 533095-xx
- Supplementary Catalog of Measures (SIL 3, PLe) 1000344-xx

Up = Power supply; Uᵢₚ = External buffer battery (false polarity can result in damage to the encoder)
Vacant pins or wires must not be used!
1) Connected inside encoder