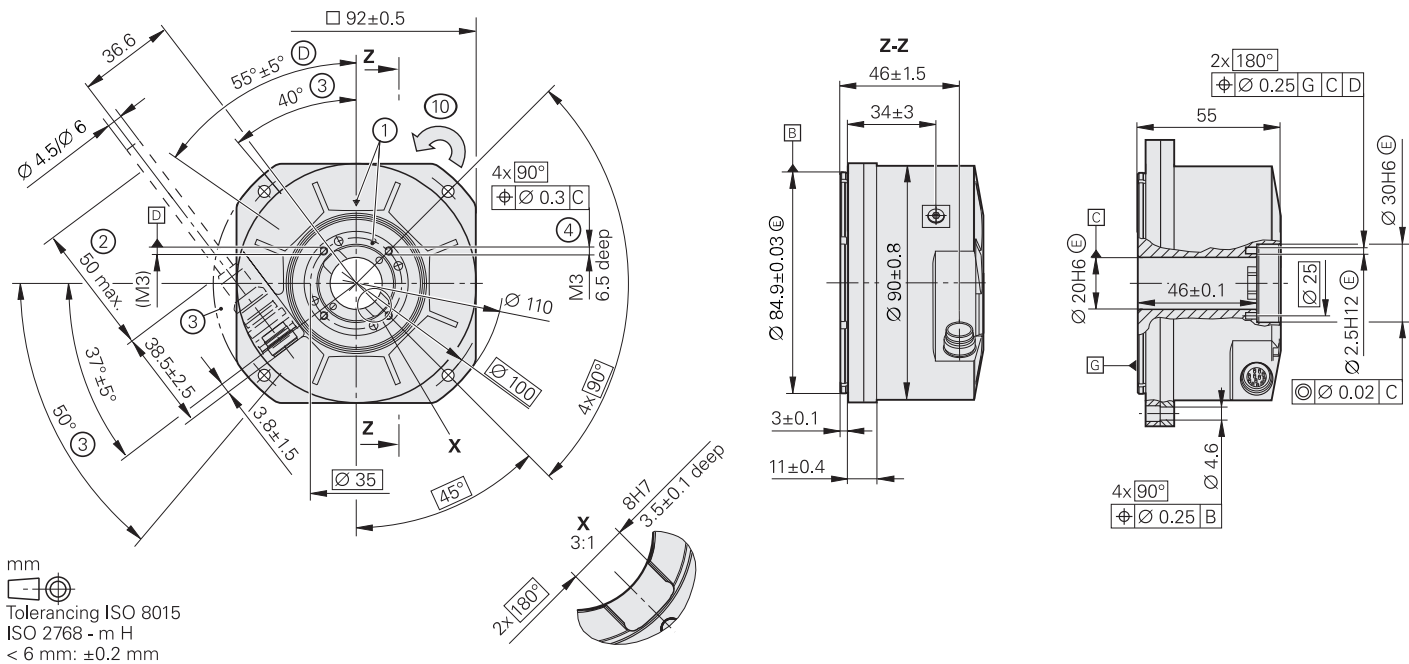


# RCN 2001 series

## Absolute angle encoders

- System accuracies:  $\pm 2''$  and  $\pm 4''$
- Transmission of the direct-drive motor temperature
- Integrated temperature sensor
- Suitability for high shaft speeds
- Hollow through shaft:  $\varnothing 20$  mm



- ▢ = Bearing of mating shaft  
⊙ = Compressed air inlet  
⊕ = Required mating dimensions  
1 = Mark for 0° position  $\pm 5^\circ$   
2 = Cable support  
3 = Customer-side free space  
4 = Thread engagement: 4.5 mm  $\pm 0.5$  mm (for M3 cylinder head screws; for details, see the mounting instructions)  
5 = Accessory: ring nut (ID 336669-03)  
6 = Accessory: catch (ID 817921-01)  
7 = Thread engagement: 8 mm  $\pm 1$  mm (for M4x20 cylinder head screws; for details, see the mounting instructions)  
8 = Two spring pins: ISO 8752 – 2.5x10 – St  
9 = If spring pins are used, then provide additional M3 back-off threads  
10 = Direction of shaft rotation for ascending position values  
11 = Stated tolerance includes mounting tolerances and thermal expansion; no dynamic movement permitted

| Specifications                                                     | Absolute<br>RCN 2511                                                                                                                                                                                                                                      | RCN 2311           |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Measuring standard                                                 | DIADUR circular scale with absolute track and incremental track (16384 lines)                                                                                                                                                                             |                    |
| System accuracy                                                    | ±2"                                                                                                                                                                                                                                                       | ±4"                |
| Position error per signal period                                   | ≤ ±0.3"                                                                                                                                                                                                                                                   | ≤ ±0.4"            |
| Functional safety<br>for applications with up to                   | <ul style="list-style-type: none"><li>SIL 2 as per EN IEC 61800-5-3 and EN 61508</li><li>Category 3, PL d as per EN ISO 13849-1</li></ul>                                                                                                                 |                    |
| PFH                                                                | ≤ 25 · 10 <sup>-9</sup> (up to 2000 m above sea level)                                                                                                                                                                                                    |                    |
| Safe position <sup>1)</sup>                                        | Encoder: ±0.22° (safety-relevant measuring step SM = 0.088°)<br>Mechanical coupling: fault exclusion for the loosening of the housing/flange and hollow shaft<br>(see <i>Functional safety</i> and <i>Mounting and accessories</i> on <i>Page 28/30</i> ) |                    |
| Interface                                                          | EnDat 2.2                                                                                                                                                                                                                                                 |                    |
| Ordering designation                                               | EnDat22                                                                                                                                                                                                                                                   |                    |
| Positions/revolution                                               | 268435456 (28 bits)                                                                                                                                                                                                                                       | 67108864 (26 bits) |
| Electrically permissible speed                                     | ≤ 3000 rpm for continuous position value                                                                                                                                                                                                                  |                    |
| Clock frequency<br>Calculation time t <sub>cal</sub>               | ≤ 16 MHz<br>≤ 5 μs                                                                                                                                                                                                                                        |                    |
| Measurement of direct-drive motor temperature <sup>2)</sup>        | Possible with the HEIDENHAIN EIB 5000 signal converter (see <i>Page 34</i> )                                                                                                                                                                              |                    |
| Electrical connection                                              | Separate adapter cable connectable to encoder via quick connector                                                                                                                                                                                         |                    |
| Cable length                                                       | ≤ 100 m (with HEIDENHAIN cable; clock frequency ≤ 8 MHz)                                                                                                                                                                                                  |                    |
| Supply voltage                                                     | DC 3.6 V to 14 V                                                                                                                                                                                                                                          |                    |
| Power consumption <sup>3)</sup><br>(maximum)                       | 3.6 V: ≤ 1.1 W<br>14 V: ≤ 1.3 W                                                                                                                                                                                                                           |                    |
| Shaft                                                              | Hollow through shaft (Ø 20 mm)                                                                                                                                                                                                                            |                    |
| Mech. permiss. shaft speed<br>(at constant speed for up to 90 min) | ≤ 3000 rpm (at an operating temperature of 40 °C;<br>for details, see the permissible shaft speeds on <i>Page 26</i> )                                                                                                                                    |                    |
| Starting torque (at 20 °C)                                         | ≤ 0.08 Nm (typical)                                                                                                                                                                                                                                       |                    |
| Moment of inertia                                                  | Rotor (hollow shaft): 180 · 10 <sup>-6</sup> kgm <sup>2</sup><br>Stator (housing/flange): 670 · 10 <sup>-6</sup> kgm <sup>2</sup>                                                                                                                         |                    |
| Permissible axial motion of measured shaft                         | Axial: ±0.3 mm <sup>4)</sup><br>Radial: Ø coaxiality: 0.2 mm; radial runout during operation: 0.04 mm (each relative to the bearing axis of the mating shaft)                                                                                             |                    |
| Natural frequency                                                  | ≥ 1000 Hz                                                                                                                                                                                                                                                 |                    |
| Vibration 55 Hz to 2000 Hz<br>Shock 6 ms                           | ≤ 200 m/s <sup>2</sup> (EN 60068-2-6)<br>≤ 200 m/s <sup>2</sup> (EN 60068-2-27)                                                                                                                                                                           |                    |
| Operating temperature                                              | 0 °C to 60 °C                                                                                                                                                                                                                                             |                    |
| Protection EN 60529                                                | IP64                                                                                                                                                                                                                                                      |                    |
| Mass                                                               | ≈ 1.1 kg                                                                                                                                                                                                                                                  |                    |

<sup>1)</sup> Further tolerances may arise in the downstream electronics after position value comparison (contact manufacturer of the downstream electronics)

<sup>2)</sup> For detailed descriptions of the signal converters for measuring the temperature of direct-drive motors, see the *EIB 5000* Product Information document

<sup>3)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>4)</sup> Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

| Specifications                                                        | Absolute<br>RCN 2581<br>RCN 2381                                                                                                                              | RCN 2591 F<br>RCN 2391 F                             | RCN 2591 M<br>RCN 2391 M           | RCN 2591 P<br>RCN 2391 P      |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------|-------------------------------|
| Measuring standard                                                    | DIADUR circular scale with absolute track and incremental track (16384 lines)                                                                                 |                                                      |                                    |                               |
| System accuracy                                                       | RCN 25x1: ±2″<br>RCN 23x1: ±4″                                                                                                                                |                                                      |                                    |                               |
| Position error per signal period                                      | RCN 2581: ≤ ±0.4″<br>RCN 2381: ≤ ±0.4″                                                                                                                        | RCN 25x1: ≤ ±0.3″<br>RCN 23x1: ≤ ±0.4″               |                                    |                               |
| Interface                                                             | EnDat 2.2                                                                                                                                                     | Fanuc Serial Interface<br>αi interface <sup>1)</sup> | Mitsubishi high speed<br>interface | Panasonic Serial<br>Interface |
| Ordering designation                                                  | EnDat02                                                                                                                                                       | Fanuc05                                              | Mit03-4                            | Pana02                        |
| Positions/rev. <sup>1)</sup>                                          | RCN 25x1: 268435456 (28 bits)<br>RCN 23x1: 67108864 (26 bits)                                                                                                 |                                                      |                                    |                               |
| Electrically permissible speed                                        | ≤ 1500 rpm for<br>continuous position<br>value                                                                                                                | ≤ 3000 rpm for continuous position value             |                                    |                               |
| Clock frequency<br>Calculation time t <sub>cal</sub>                  | ≤ 2 MHz<br>≤ 8 μs                                                                                                                                             | –                                                    |                                    |                               |
| Incremental signals<br>Cutoff frequency –3 dB                         | ~ 1 V <sub>PP</sub><br>≥ 400 kHz                                                                                                                              | –                                                    |                                    |                               |
| Measurement of direct-drive<br>motor temperature <sup>2)</sup>        | Possible with the HEIDENHAIN EIB 5000 signal<br>converter (see <i>Page 34</i> )                                                                               |                                                      | –                                  |                               |
| Electrical connection                                                 | Separate adapter cable connectable to encoder via quick connector                                                                                             |                                                      |                                    |                               |
| Cable length <sup>3)</sup>                                            | ≤ 150 m                                                                                                                                                       | ≤ 50 m                                               | ≤ 30 m                             |                               |
| Supply voltage                                                        | DC 3.6 V to 14 V                                                                                                                                              |                                                      |                                    |                               |
| Power consumption <sup>4)</sup><br>(maximum)                          | 3.6 V: ≤ 1.1 W<br>14 V: ≤ 1.3 W                                                                                                                               |                                                      |                                    |                               |
| Shaft                                                                 | Hollow through shaft (Ø 20 mm)                                                                                                                                |                                                      |                                    |                               |
| Mech. permiss. shaft speed<br>(at constant speed for up to<br>90 min) | RCN 2x81: ≤ 1500 rpm<br>RCN 2x91: ≤ 3000 rpm (at an operating temperature of 40 °C;<br>for more details, see the permissible shaft speeds on <i>Page 26</i> ) |                                                      |                                    |                               |
| Starting torque (at 20 °C)                                            | Typically ≤ 0.08 Nm                                                                                                                                           |                                                      |                                    |                               |
| Moment of inertia                                                     | Rotor (hollow shaft): 180 · 10 <sup>–6</sup> kgm <sup>2</sup> ; stator (housing/flange): 670 · 10 <sup>–6</sup> kgm <sup>2</sup>                              |                                                      |                                    |                               |
| Permissible axial motion of<br>measured shaft                         | Axial: ±0.3 mm <sup>5)</sup><br>Radial: Ø 0.2 mm coaxiality and 0.04 mm runout during operation<br>(each relative to the bearing axis of the mating shaft)    |                                                      |                                    |                               |
| Natural frequency                                                     | ≥ 1000 Hz                                                                                                                                                     |                                                      |                                    |                               |
| Vibration 55 Hz to 2000 Hz<br>Shock 6 ms                              | ≤ 200 m/s <sup>2</sup> (EN 60068-2-6)<br>≤ 200 m/s <sup>2</sup> (EN 60068-2-27)                                                                               |                                                      |                                    |                               |
| Operating temperature                                                 | 0 °C to 60 °C                                                                                                                                                 |                                                      |                                    |                               |
| Protection EN 60529                                                   | IP64                                                                                                                                                          |                                                      |                                    |                               |
| Mass                                                                  | ≈ 1.1 kg                                                                                                                                                      |                                                      |                                    |                               |

<sup>1)</sup> Reduced resolution during operation for the Fanuc  $\alpha$  interface; RCN 2591 F: 134 217 728 (27 bits); RCN 2391 F: 8388 608 (23 bits)

<sup>2)</sup> For detailed descriptions of the signal converters for measuring the temperature of direct-drive motors, see the *EIB 5000* Product Information document

<sup>3)</sup> With HEIDENHAIN cable  $\leq 8$  MHz

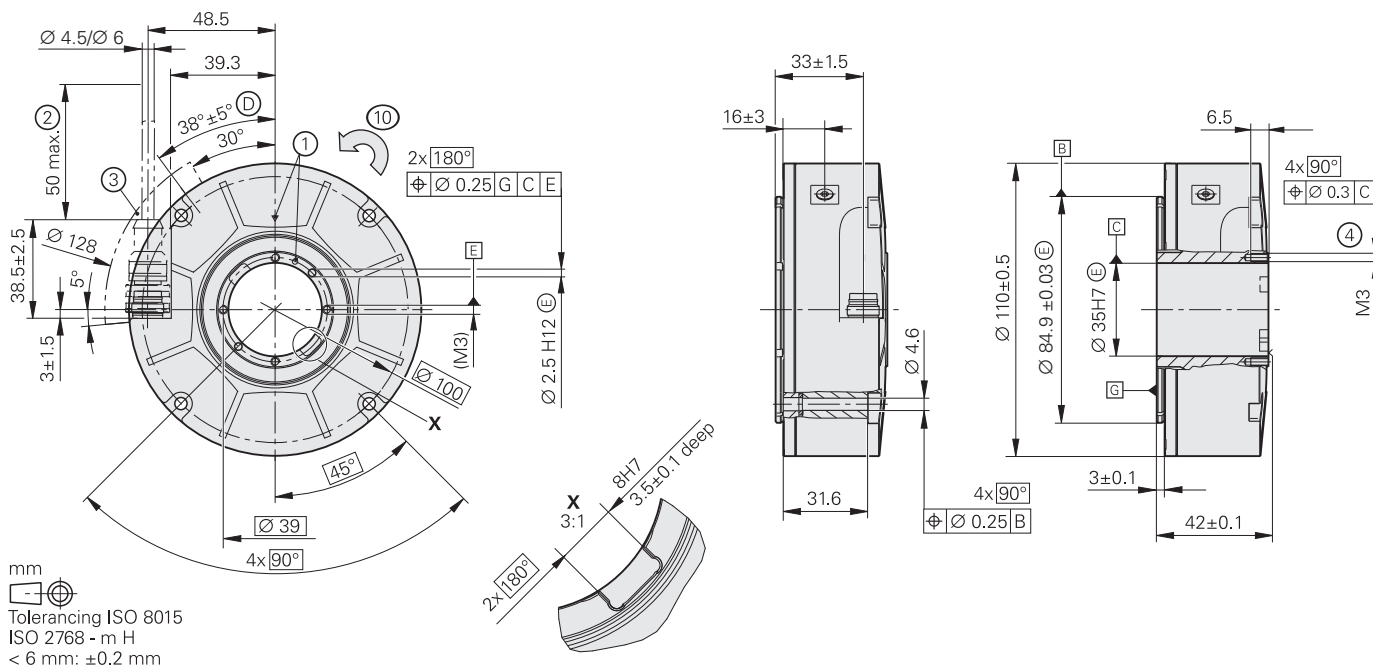
<sup>4)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>5)</sup> Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

# RCN 5001 series

## Absolute angle encoders

- System accuracies:  $\pm 2''$  and  $\pm 4''$
- Transmission of the direct-drive motor temperature
- Integrated temperature sensor
- Suitability for high shaft speeds
- Hollow through shaft:  $\varnothing 35 \text{ mm}$



- ⊠ = Bearing of mating shaft
- ⊙ = Compressed air inlet
- ⊕ = Required mating dimensions
- 1 = Mark for 0° position ±5°
- 2 = Cable support
- 3 = Customer-side free space
- 4 = Thread engagement: 4.5 mm ±0.5 mm (for M3 cylinder head screws; for details, see the mounting instructions)
- 5 = Accessory: ring nut (ID 336669-17)
- 6 = Accessory: catch (ID 817921-02)
- 7 = Thread engagement: 8 mm ±1 mm (for M4x20 cylinder head screws; for details, see the mounting instructions)
- 8 = Two spring pins: ISO 8752 – 2.5x10 – St
- 9 = If spring pins are used, then provide additional M3 back-off threads
- 10 = Direction of shaft rotation for ascending position values
- 11 = Stated tolerance includes mounting tolerances and thermal expansion; no dynamic movement permitted

| Specifications                                                     | Absolute<br>RCN 5511                                                                                                                                                                                                                                      |  | RCN 5311                                                                           |  |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------|--|
|                                                                    |                                                                                                                                                                           |  |  |  |
| Measuring standard                                                 | DIADUR circular scale with absolute track and incremental track (16384 lines)                                                                                                                                                                             |  |                                                                                    |  |
| System accuracy                                                    | ±2"                                                                                                                                                                                                                                                       |  | ±4"                                                                                |  |
| Position error per signal period                                   | ≤ ±0.3"                                                                                                                                                                                                                                                   |  | ≤ ±0.4"                                                                            |  |
| Functional safety<br>for applications with up to                   | <ul style="list-style-type: none"><li>• SIL 2 as per EN IEC 61800-5-3 and EN 61508</li><li>• Category 3, PL d as per EN ISO 13849-1</li></ul>                                                                                                             |  |                                                                                    |  |
| PFH                                                                | ≤ 25 · 10 <sup>-9</sup> (up to 2000 m above sea level)                                                                                                                                                                                                    |  |                                                                                    |  |
| Safe position <sup>1)</sup>                                        | Encoder: ±0.22° (safety-relevant measuring step SM = 0.088°)<br>Mechanical coupling: fault exclusion for the loosening of the housing/flange and hollow shaft<br>(see <i>Functional safety</i> and <i>Mounting and accessories</i> on <i>Page 28/30</i> ) |  |                                                                                    |  |
| Interface                                                          | EnDat 2.2                                                                                                                                                                                                                                                 |  |                                                                                    |  |
| Ordering designation                                               | EnDat22                                                                                                                                                                                                                                                   |  |                                                                                    |  |
| Positions/revolution                                               | 268435456 (28 bits)                                                                                                                                                                                                                                       |  | 67108864 (26 bits)                                                                 |  |
| Electrically permissible speed                                     | ≤ 3000 rpm for continuous position value                                                                                                                                                                                                                  |  |                                                                                    |  |
| Clock frequency<br>Calculation time t <sub>cal</sub>               | ≤ 16 MHz<br>≤ 5 μs                                                                                                                                                                                                                                        |  |                                                                                    |  |
| Measurement of direct-drive motor temperature <sup>2)</sup>        | Possible with the HEIDENHAIN EIB 5000 signal converter (see <i>Page 34</i> )                                                                                                                                                                              |  |                                                                                    |  |
| Electrical connection                                              | Separate adapter cable connectable to encoder via quick connector                                                                                                                                                                                         |  |                                                                                    |  |
| Cable length                                                       | ≤ 100 m (with HEIDENHAIN cable; clock frequency ≤ 8 MHz)                                                                                                                                                                                                  |  |                                                                                    |  |
| Supply voltage                                                     | DC 3.6 V to 14 V                                                                                                                                                                                                                                          |  |                                                                                    |  |
| Power consumption <sup>3)</sup><br>(maximum)                       | 3.6 V: ≤ 1.1 W<br>14 V: ≤ 1.3 W                                                                                                                                                                                                                           |  |                                                                                    |  |
| Shaft                                                              | Hollow through shaft (Ø 35 mm)                                                                                                                                                                                                                            |  |                                                                                    |  |
| Mech. permiss. shaft speed<br>(at constant speed for up to 90 min) | ≤ 2000 rpm (at an operating temperature of 40 °C;<br>for details, see the permissible shaft speeds on <i>Page 26</i> )                                                                                                                                    |  |                                                                                    |  |
| Starting torque (at 20 °C)                                         | ≤ 0.2 Nm (typical)                                                                                                                                                                                                                                        |  |                                                                                    |  |
| Moment of inertia                                                  | Rotor (hollow shaft): 130 · 10 <sup>-6</sup> kgm <sup>2</sup><br>Stator (housing/flange): 1010 · 10 <sup>-6</sup> kgm <sup>2</sup>                                                                                                                        |  |                                                                                    |  |
| Permissible axial motion of measured shaft                         | Axial: ±0.3 mm <sup>4)</sup><br>Radial: Ø coaxiality: 0.2 mm; radial runout during operation: 0.04 mm (each relative to the bearing axis of the mating shaft)                                                                                             |  |                                                                                    |  |
| Natural frequency                                                  | ≥ 1000 Hz                                                                                                                                                                                                                                                 |  |                                                                                    |  |
| Vibration 55 Hz to 2000 Hz<br>Shock 6 ms                           | ≤ 200 m/s <sup>2</sup> (EN 60068-2-6)<br>≤ 200 m/s <sup>2</sup> (EN 60068-2-27)                                                                                                                                                                           |  |                                                                                    |  |
| Operating temperature                                              | 0 °C to 60 °C                                                                                                                                                                                                                                             |  |                                                                                    |  |
| Protection EN 60529                                                | IP64                                                                                                                                                                                                                                                      |  |                                                                                    |  |
| Mass                                                               | ≈ 0.9 kg                                                                                                                                                                                                                                                  |  |                                                                                    |  |

<sup>1)</sup> Further tolerances may arise in the downstream electronics after position value comparison (contact manufacturer of the downstream electronics)

<sup>2)</sup> For detailed descriptions of the signal converters for measuring the temperature of direct-drive motors, see the *EIB 5000* Product Information document

<sup>3)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>4)</sup> Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

| Specifications                                                        | Absolute<br>RCN 5581<br>RCN 5381                                                                                                                                                                                                            | RCN 5591 F<br>RCN 5391 F                             | RCN 5591 M<br>RCN 5391 M           | RCN 5591 P<br>RCN 5391 P      |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------|-------------------------------|
| Measuring standard                                                    | DIADUR circular scale with absolute track and incremental track (16384 lines)                                                                                                                                                               |                                                      |                                    |                               |
| System accuracy                                                       | RCN 55x1: ±2"<br>RCN 53x1: ±4"                                                                                                                                                                                                              |                                                      |                                    |                               |
| Position error per signal period                                      | RCN 5581: ≤ ±0.4"<br>RCN 5381: ≤ ±0.4"                                                                                                                                                                                                      | RCN 55x1: ≤ ±0.3"<br>RCN 53x1: ≤ ±0.4"               |                                    |                               |
| Interface                                                             | EnDat 2.2                                                                                                                                                                                                                                   | Fanuc Serial Interface<br>αi interface <sup>1)</sup> | Mitsubishi high speed<br>interface | Panasonic Serial<br>Interface |
| Ordering designation                                                  | EnDat02                                                                                                                                                                                                                                     | Fanuc05                                              | Mit03-4                            | Pana02                        |
| Positions/rev. <sup>1)</sup>                                          | RCN 55x1: 268435456 (28 bits)<br>RCN 53x1: 67 108 864 (26 bits)                                                                                                                                                                             |                                                      |                                    |                               |
| Electrically permissible speed                                        | ≤ 1500 rpm for<br>continuous position<br>value                                                                                                                                                                                              | ≤ 3000 rpm for continuous position value             |                                    |                               |
| Clock frequency<br>Calculation time t <sub>cal</sub>                  | ≤ 2 MHz<br>≤ 8 μs                                                                                                                                                                                                                           | –                                                    |                                    |                               |
| Incremental signals<br>Cutoff frequency –3 dB                         | ~ 1 V <sub>PP</sub><br>≥ 400 kHz                                                                                                                                                                                                            | –                                                    |                                    |                               |
| Measurement of direct-drive<br>motor temperature <sup>2)</sup>        | Possible with the HEIDENHAIN EIB 5000 signal<br>converter (see <i>Page 34</i> )                                                                                                                                                             |                                                      | –                                  |                               |
| Electrical connection                                                 | Separate adapter cable connectable to encoder via quick connector                                                                                                                                                                           |                                                      |                                    |                               |
| Cable length <sup>3)</sup>                                            | ≤ 150 m                                                                                                                                                                                                                                     | ≤ 50 m                                               | ≤ 30 m                             |                               |
| Supply voltage                                                        | DC 3.6 V to 14 V                                                                                                                                                                                                                            |                                                      |                                    |                               |
| Power consumption <sup>4)</sup><br>(maximum)                          | 3.6 V: ≤ 1.1 W<br>14 V: ≤ 1.3 W                                                                                                                                                                                                             |                                                      |                                    |                               |
| Shaft                                                                 | Hollow through shaft (Ø 35 mm)                                                                                                                                                                                                              |                                                      |                                    |                               |
| Mech. permiss. shaft speed<br>(at constant speed for up to<br>90 min) | RCN 5x81: ≤ 1500 rpm (operating temperature ≤ 50 °C)<br>≤ 1200 rpm (operating temperature > 50 °C)<br>RCN 5x91: ≤ 2000 rpm (at an operating temperature of 40 °C;<br>for more details, see the permissible shaft speeds on <i>Page 26</i> ) |                                                      |                                    |                               |
| Starting torque (at 20 °C)                                            | Typically ≤ 0.2 Nm                                                                                                                                                                                                                          |                                                      |                                    |                               |
| Moment of inertia                                                     | Rotor (hollow shaft): 130 · 10 <sup>–6</sup> kgm <sup>2</sup> ; stator (housing/flange): 1010 · 10 <sup>–6</sup> kgm <sup>2</sup>                                                                                                           |                                                      |                                    |                               |
| Permissible axial motion of<br>measured shaft                         | Axial: ±0.3 mm <sup>5)</sup><br>Radial: Ø 0.2 mm coaxiality and 0.04 mm runout during operation<br>(each relative to the bearing axis of the mating shaft)                                                                                  |                                                      |                                    |                               |
| Natural frequency                                                     | ≥ 1000 Hz                                                                                                                                                                                                                                   |                                                      |                                    |                               |
| Vibration 55 Hz to 2000 Hz<br>Shock 6 ms                              | ≤ 200 m/s <sup>2</sup> (EN 60068-2-6)<br>≤ 200 m/s <sup>2</sup> (EN 60068-2-27)                                                                                                                                                             |                                                      |                                    |                               |
| Operating temperature                                                 | 0 °C to 60 °C                                                                                                                                                                                                                               |                                                      |                                    |                               |
| Protection EN 60529                                                   | IP64                                                                                                                                                                                                                                        |                                                      |                                    |                               |
| Mass                                                                  | ≈ 0.9 kg                                                                                                                                                                                                                                    |                                                      |                                    |                               |

<sup>1)</sup> Reduced resolution during operation for the Fanuc α interface; RCN 5591 F: 134217728 (27 bits); RCN 5391 F: 8388608 (23 bits)

<sup>2)</sup> For detailed descriptions of the signal converters for measuring the temperature of direct-drive motors, see the *EIB 5000* Product Information document

<sup>3)</sup> With HEIDENHAIN cable ≤ 8 MHz

<sup>4)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>5)</sup> Range includes mounting tolerances and thermal expansion; no dynamic movement permitted