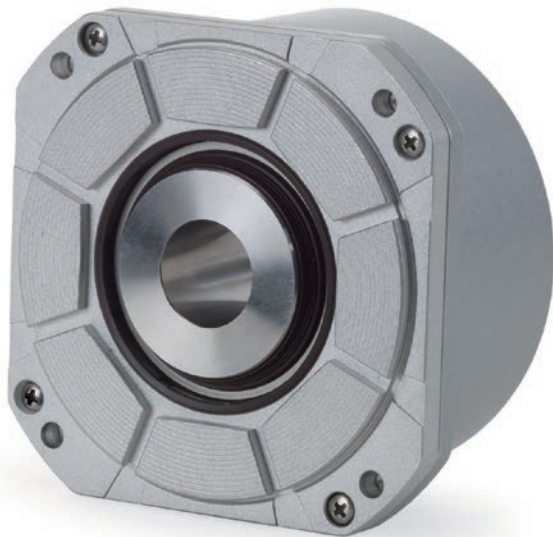




# HEIDENHAIN



Preliminary  
Product Information

## **RCN 2001**

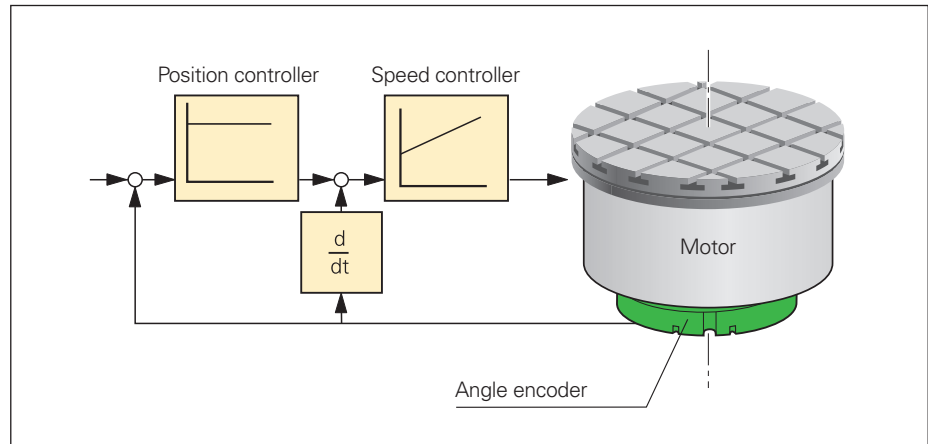
Absolute Angle Encoders  
for High Productivity

# Angle encoders for direct drive motors in machine tools

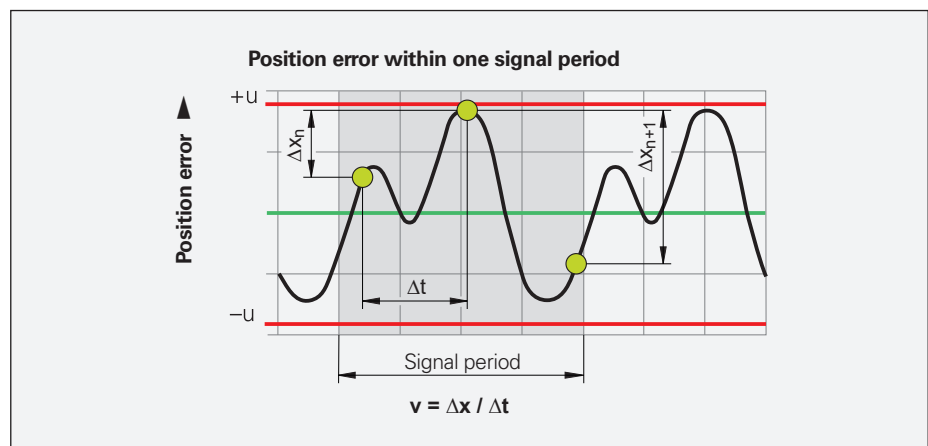
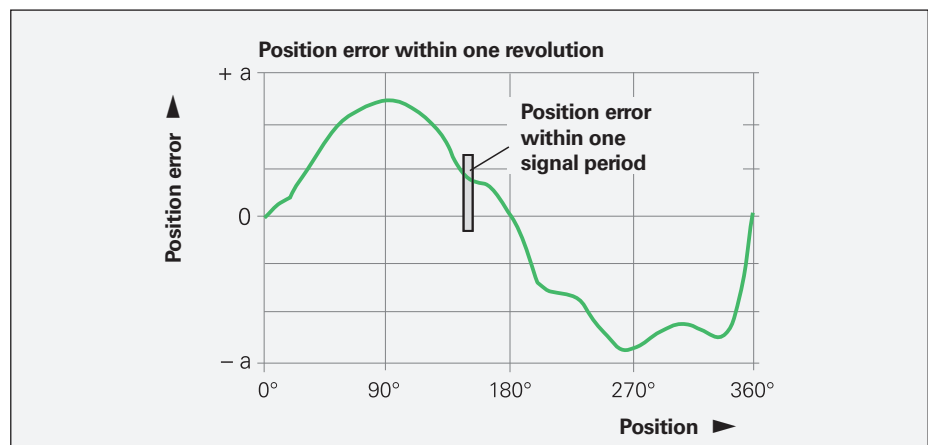
Direct drive motors are finding increasing use in many fields, particularly in the machine tool industry. Compared with rotary axes with mechanical transmission elements, direct drive motors exhibit extremely low-wear and low-maintenance characteristics. By eliminating the need for any intervening mechanical drive components, torque motors also enable significantly higher dynamic performance. Thanks to the direct translation of force, considerably higher accelerations and shaft speeds are attainable. This is particularly advantageous in 5-axis simultaneous machining because it is usually the rotary axes that limit speed in simultaneous motion systems. Thus, rotary axes with higher dynamic performance enable smoother tool feed rates and increased productivity.

The performance of a direct-drive feed axis is heavily influenced by the type of encoder being used to measure axis position. Encoders with the optical scanning method offer special benefits in terms of the accuracy, speed stability, and thermal behavior of the driven feed axis.

In direct-drive feed axes, encoders are used to determine both the actual position and the momentary speed. Due to the absence of any mechanical transmission elements between the encoder and the motor, these encoders must possess a correspondingly high resolution in order to enable high-quality speed control even at low feed rates. Furthermore, higher  $k_V$  factors in the position control loop of direct drive motors allow larger control bandwidths and servo stiffness to be tuned. However, this also magnifies the influence of the encoder's signal quality on positioning behavior and control-loop behavior. Position errors within one signal period adversely affect the positioning accuracy and speed stability of the motor. At low feed rates, the feed motor, and therefore the rotary axis, reproduces the position errors within one signal period. Because direct drive motors possess a larger control bandwidth due to the higher  $k_V$  factor, they reproduce these position errors over a wider speed range of the feed axis.



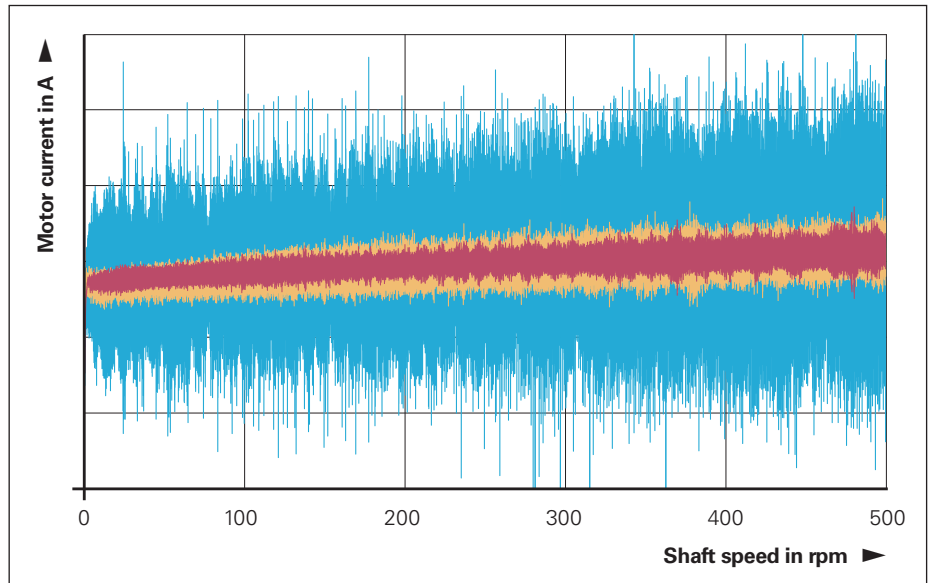
Control loop with rotational direct drive motor (torque motor)



Position error within one signal period with effects on speed stability

The speed controller calculates the nominal currents that brake or accelerate the motor in accordance with the control error. Inadequate signal quality of the encoder in the direct-drive axis causes disturbances not only in the position control loop but also in the underlying control loops all the way down to the current control loop. This leads to high noise levels in the motor current signal and, in particularly bad cases, to unwanted high-frequency noise in the power train. As a result, the loop gain must be reduced. The high current noise causes increased power dissipation within the motor. This results in greater heat build-up within the axis unit. Consequently, thermally caused deformations in the axis structure may arise, requiring the machine to provide more cooling to the drive system. To avoid all of these problems, direct-drive feed axes require position encoders with very small signal periods and high signal quality.

The RCN angle encoders from HEIDENHAIN are characterized by their high line count and outstanding signal quality. With these encoders, direct-drive rotary axes exhibit low motor current noise and smooth operating behavior. The high signal quality of optical encoders therefore allows better use of the performance potential of direct-drive feed axes.



Example: comparison of the current noise behavior of optical and non-optical angle encoders in rotary tables with a direct drive motor at continuously increasing shaft speeds

- Optical angle encoder with 32 768 lines
- Optical angle encoder with 16 384 lines
- Non-optical angle encoder with 2 600 lines

# Benefits of the RCN 2001 compared with the predecessor model

## High system accuracy

Thanks to its optimization (e.g. with regard to scanning), the new RCN 2001 series can be specified with a **system accuracy of  $\pm 2''$  and  $\pm 4''$** .

Despite the same wide mounting tolerances (e.g., up to  $\pm 0.3$  mm axially), the system accuracy takes the following types of errors into account:

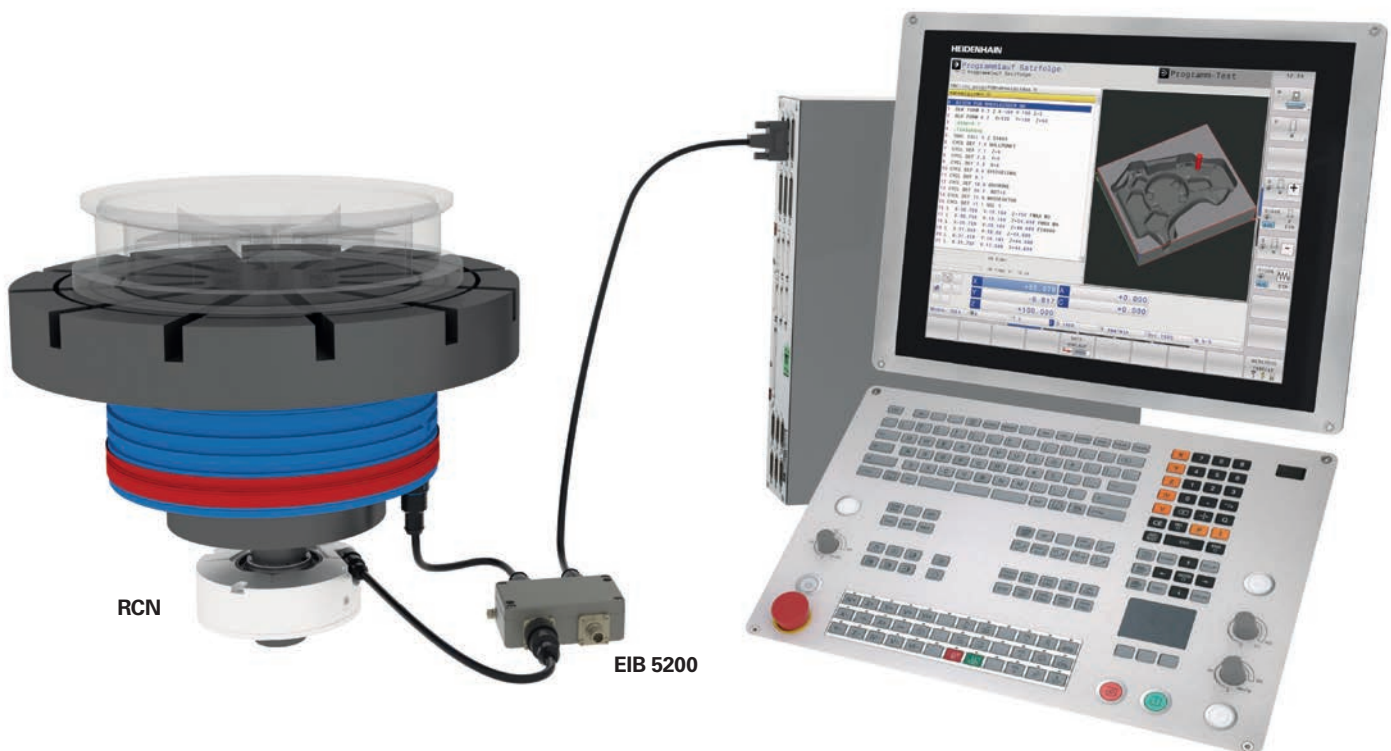
- Position error within one revolution
- Position error within one signal period
- Coupling-related error

## Convenient measurement of direct-drive motor temperature

In order to prevent direct drive motors from overheating during operation, temperature monitoring is typically employed. The new RCN 2001 series in conjunction with the HEIDENHAIN EIB 5200 sensor box enables evaluation of the winding temperature. The sensor box is installed in close proximity to the direct drive motor and digitalizes the **direct drive motor's temperature data** close to the application. In addition to the position data, the processed temperature data are transmitted to the control via the purely digital interface (EnDat, Fanuc, or DRIVE CLiQ, e.g., via the EIB 3392 S interface box in cable form).

This yields the following practical benefits:

- Reduced cabling
- Purely digital transmission technology
- Protection of the drive motor from overloading thanks to monitoring of all three windings
- Precise temperature monitoring through compensation of the transmission timing behavior of the temperature measurement (with direct drive motors from ETEL)
- Increased cost efficiency through full use of the direct drive motor up to its thermal loading limit



Combination of RCN encoder and EIB 5200 sensor box

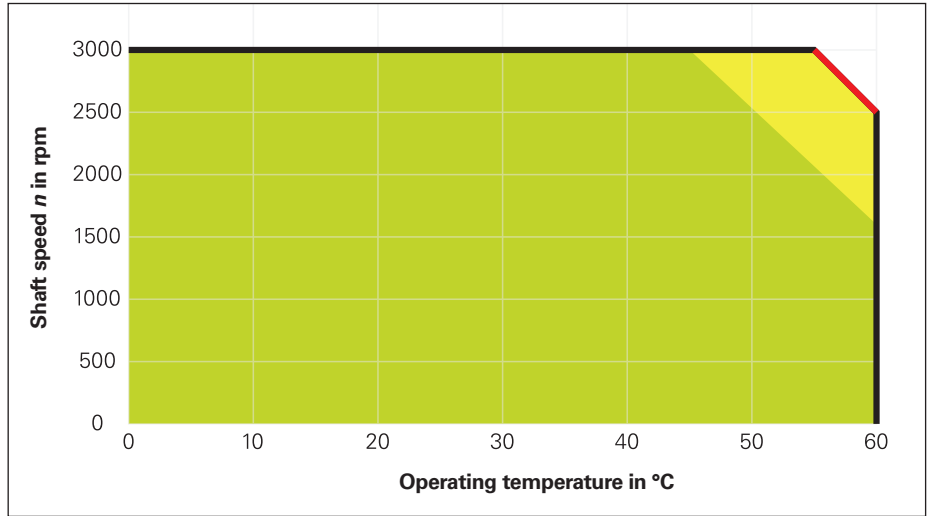
**High permissible shaft speed**

With the RCN 2001 series featuring a purely serial interface, **shaft speeds of up to 3000 rpm** are possible. However, the permissible shaft speed is largely dependent on the encoder temperature, which, in turn, is influenced by the machining time and operating temperature. The operating temperature is defined as the temperature within the immediate vicinity of the encoder, but not at the encoder's surface.

To protect the encoder from overheating, the RCN 2001 is equipped with a temperature sensor. This sensor measures the temperature within the encoder and transmits it to the subsequent electronics. When the temperature within the encoder is too high (90 °C), an alarm is generated, and the machine's control takes appropriate measures to protect the encoder from damage. When the EnDat interface is used, a warning bit is set when the temperature inside the encoder reaches 86 °C. This can be used to trigger configurable machine actions to avoid interruption of the machining process.

The following speed diagram was created as an aid to orientation and is based on an analysis of encoder temperatures from tests performed under varying temperatures and shaft speeds. The diagram shows the permissible shaft speeds as a function of the operating temperature (valid for up to 90 minutes of uninterrupted operation).

The green region shows the relationship between the operating temperature and the permissible shaft speeds at which the temperature inside the encoder is non-critical. In the yellow region, the combination of shaft speed and operating temperature yields an encoder temperature that is high enough for the EnDat interface to generate a warning bit. At the red line, the encoder temperature has reached 90 °C, and an alarm bit for overheating is set.





Shaft-speed diagram for the RCN 2001 series with purely serial interface as an aid to orientation

- Permissible speed range
- Expanded speed range, requiring encoder temperature monitoring
- Specification boundary (max. permissible shaft speed: 3000 rpm and max. permissible operating temperature: 60 °C)
- Generation of an alarm bit due to high encoder temperature





Specifications	Absolute RCN 2511 	RCN 2311 
<b>Measuring standard</b>	DIADUR circular scale with absolute track and incremental track (16 384 lines)	
<b>System accuracy</b>	±2"	±4"
Position error per signal period	≤ ±0.3"	≤ ±0.4"
<b>Functional safety</b> for applications up to	<ul style="list-style-type: none"> <li>SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2)</li> <li>Category 3, PL d as per EN ISO 13849-1:2015</li> </ul>	
PFH	≤ 25 · 10 <sup>-9</sup>	
Safe position <sup>1)</sup>	<i>Encoder:</i> ±0.22° (safety-related measuring step SM = 0.088°) <i>Mechanical coupling:</i> fault exclusion for the loosening of housing/flange and hollow shaft (see <i>Functional safety</i> and <i>Mounting</i> on pages 10 and 11)	
<b>Interface</b>	EnDat 2.2	
Ordering designation	EnDat22	
Positions per revolution	268 435 456 (28 bits)	67 108 864 (26 bits)
Electrically permissible speed	≤ 3000 rpm for continuous position value	
Clock frequency Calculation time t <sub>cal</sub>	≤ 16 MHz ≤ 5 μs	
<b>Electrical connection</b>	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>2)</sup> (maximum)	3.6 V: ≤ 1.1 W 14 V: ≤ 1.3 W	
Current consumption (typical)	5 V: 140 mA (without load)	
<b>Shaft</b>	Hollow through shaft D = 20 mm	
Mech. permissible speed	≤ 3000 rpm (at an operating temperature of 40 °C; for details, see <i>High permissible shaft speed</i> on page 5)	
Starting torque (at 20 °C)	≤ 0.08 Nm (typical)	
Moment of inertia	<i>Rotor (hollow shaft):</i> 180 · 10 <sup>-6</sup> kgm <sup>2</sup> <i>Stator (housing/flange):</i> 670 · 10 <sup>-6</sup> kgm <sup>2</sup>	
Permissible axial motion of measured shaft	<i>Axial:</i> ±0.3 mm <sup>3)</sup> <i>Radial:</i> Ø 0.2 mm coaxiality and, during operation, 0.04 mm radial runout (each relative to the bearing axis of the mating shaft)	
<b>Natural frequency</b>	≥ 1000 Hz	
<b>Vibration</b> 55 Hz to 2000 Hz <b>Shock</b> 6 ms	≤ 200 m/s <sup>2</sup> (EN 60068-2-6) ≤ 200 m/s <sup>2</sup> (EN 60068-2-27)	
<b>Operating temperature</b>	0 °C to 60 °C	
<b>Protection</b> EN 60529	IP64	
<b>Mass</b>	≈ 1.1 kg	

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

<sup>2)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>3)</sup> Range includes mounting tolerances and thermal expansion.  
No dynamic movement permitted.



Specifications	Absolute			
	RCN 2511 RCN 2311	RCN 2581* RCN 2381*	RCN 2591F* RCN 2391F*	RCN 2591M* RCN 2391M*
<b>Measuring standard</b>	DIADUR circular scale with absolute track and incremental track (16 384 lines)			
<b>System accuracy</b>	RCN 25x1: ±2" RCN 23x1: ±4"			
Position error per signal period	RCN 25x1: ≤ ±0.3" RCN 23x1: ≤ ±0.4"	RCN 2581: ≤ ±0.4" RCN 2381: ≤ ±0.4"	RCN 25x1: ≤ ±0.3" RCN 23x1: ≤ ±0.4"	
<b>Interface</b>	EnDat 2.2		Fanuc Serial Interface αi interface	Mitsubishi high speed interface
Ordering designation	EnDat22	EnDat02	Fanuc05	Mit03-4
Position values per revolution	RCN 25x1: 268435456 (28 bits) RCN 23x1: 67 108864 (26 bits)			
Electrically permissible speed	≤ 3000 rpm for continuous position value	≤ 1500 rpm for continuous position value	≤ 3000 rpm for continuous position value	
Clock frequency Calculation time $t_{cal}$	≤ 16 MHz ≤ 5 μs	≤ 2 MHz ≤ 8 μs	–	
Incremental signals Cutoff frequency –3 dB	–	~ 1 V <sub>PP</sub> ≥ 400 kHz	–	
<b>Electrical connection</b>	Separate adapter cable connectable to encoder; via quick connector			
Cable length <sup>1)</sup>	≤ 150 m		≤ 50 m	≤ 30 m
Supply voltage	DC 3.6 V to 14 V			
Power consumption <sup>2)</sup> (maximum)	3.6 V: ≤ 1.1 W 14 V: ≤ 1.3 W			
Current consumption (typical)	5 V: ≤ 140 mA (without load)			
<b>Shaft</b>	Hollow through shaft D = 20 mm			
Mech. permissible speed	≤ 3000 rpm (at an operating temperature of 40 °C; for details, see <i>High permissible shaft speed</i> on page 5) RCN 2x81: ≤ 1500 rpm			
Starting torque (at 20 °C)	Typically ≤ 0.08 Nm			
Moment of inertia	Rotor (hollow shaft): $180 \cdot 10^{-6} \text{ kgm}^2$ Stator (housing/flange): $670 \cdot 10^{-6} \text{ kgm}^2$			
Permissible axial motion of measured shaft	Axial: ±0.3 mm <sup>3)</sup> Radial: ∅ 0.2 mm coaxiality and, during operation, 0.04 mm radial runout (each relative to the bearing axis of the mating shaft)			
<b>Natural frequency</b>	≥ 1000 Hz			
<b>Vibration</b> 55 Hz to 2000 Hz <b>Shock</b> 6 ms	≤ 200 m/s <sup>2</sup> (EN 60068-2-6) ≤ 200 m/s <sup>2</sup> (EN 60068-2-27)			
<b>Operating temperature</b>	0 °C to 60 °C			
<b>Protection</b> EN 60529	IP64			
<b>Mass</b>	≈ 1.1 kg			

\* Available starting at the end of 2020

<sup>1)</sup> With HEIDENHAIN cable ≤ 8 MHz

<sup>2)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>3)</sup> Range includes mounting tolerances and thermal expansion.  
No dynamic movement permitted.

# Functional safety

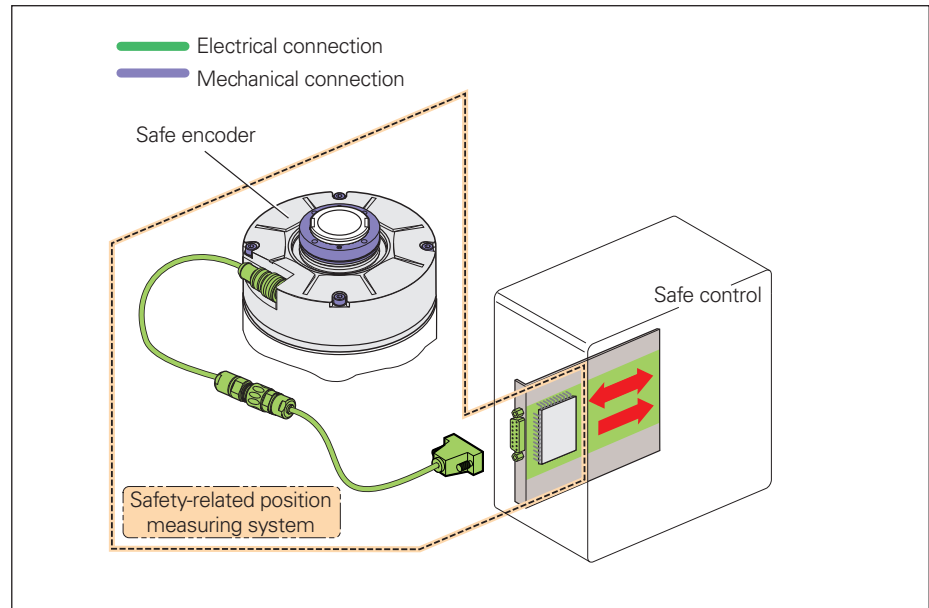
With the RCN 2001 absolute angle encoders, HEIDENHAIN offers the ideal solution for position measurement on rotary axes in safety-related applications. In conjunction with a safe control, these encoders can be used as single-encoder systems in applications with control category SIL 2 (as per EN 61508) or Performance level "d" (as per EN ISO 13849).

Reliable position transmission is based on two independently generated absolute position values and on error bits made available to the safe control. The functions of the encoder can be used for numerous safety functions in the complete system as per EN 61800-5-2 (see table).

The RCN 2001 angle encoders provides a safe, absolute position value at all times, even immediately upon switch-on. Purely serial data transmission is performed via the bidirectional EnDat 2.2 interface.

In addition to the data interface, the mechanical connection of the encoder to the motor is also safety-relevant. Table D16 of the EN 61800-5-2 standard for electrical drives defines the loosening of the mechanical connection between the

encoder and motor as a fault that requires consideration. Since the control is not necessarily able to detect such errors, fault exclusion for the loosening of the mechanical connection is required in many cases.



Safety-related position measuring system with mechanical connection and electrical interface

## Fault exclusion for the loosening of the mechanical connection

For the RCN 2001, there are several fastening methods that provide this kind of fault exclusion. Whereas the housing or flange is normally fastened with screws, special factors must be considered for the hollow shaft connection. For more information on this topic and on limitations to the specifications, please refer to the following table.

Fault exclusion is thereby possible for the loosening of the mechanical connection between the encoder and the machine shaft or customer fastening components. For the mechanical fault exclusion design for other purely customer-side connections, the following encoder torque must be taken into account:

$$M_{\text{Max}} = J \cdot \alpha + M_{\text{Friction}}$$

J: Moment of inertia of the encoder (rotor or stator; see the specifications) and of the mechanical connection (e.g., ring nut and catch when acceleration is applied via the hollow shaft and shaft coupling via these components)

$\alpha$ : Maximum angular acceleration in the application

$$M_{\text{Friction}}: 4.5 \text{ Nm}$$

Mechanical connection	Fastening <sup>1)</sup>	Safe position for the mechanical coupling <sup>2)</sup>	Limited specifications <sup>3)</sup>
Housing/flange	Screws: M4 ISO 4762 8.8	±0°	See permissible angular accelerations in <i>Mounting</i>
Hollow shaft Shaft coupling with ring nut	Ring nut and catch (see <i>Mounting</i> )	±0.55°	
Hollow shaft Front-face shaft coupling	Screws: M3 ISO 4762 8.8 Spring pins: ISO 8752 – 2.5x10 – St	±0.07°	

<sup>1)</sup> A suitable anti-rotation lock must be used for the screw connections (mounting/servicing)

<sup>2)</sup> Fault exclusion is granted only for the explicitly mentioned mounting options

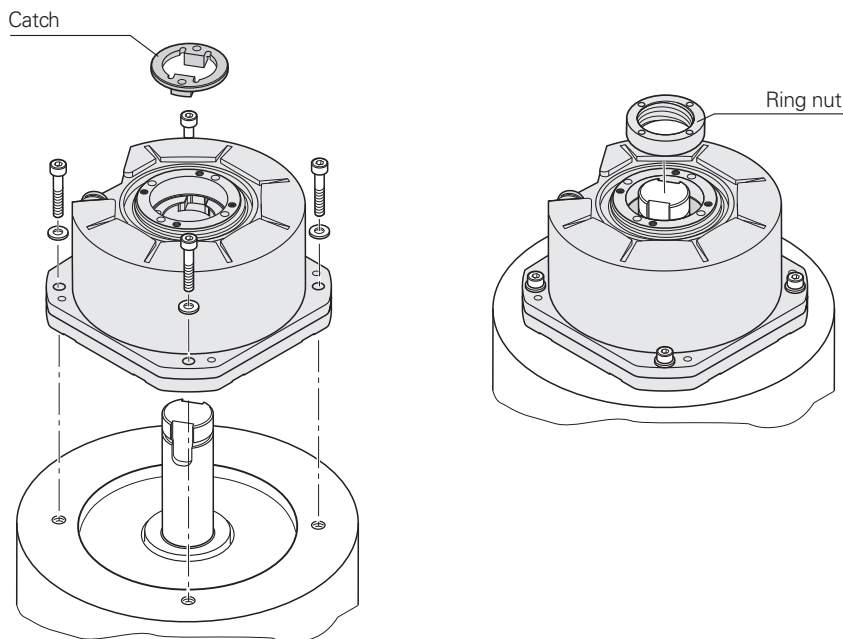
<sup>3)</sup> Compared with mounting without mechanical fault exclusion

# Mounting with mechanical fault exclusion

The housing of the RCN is firmly connected to the mounting surfaces of the machine component via a mounting flange and centering collar.

## Shaft coupling with ring nut

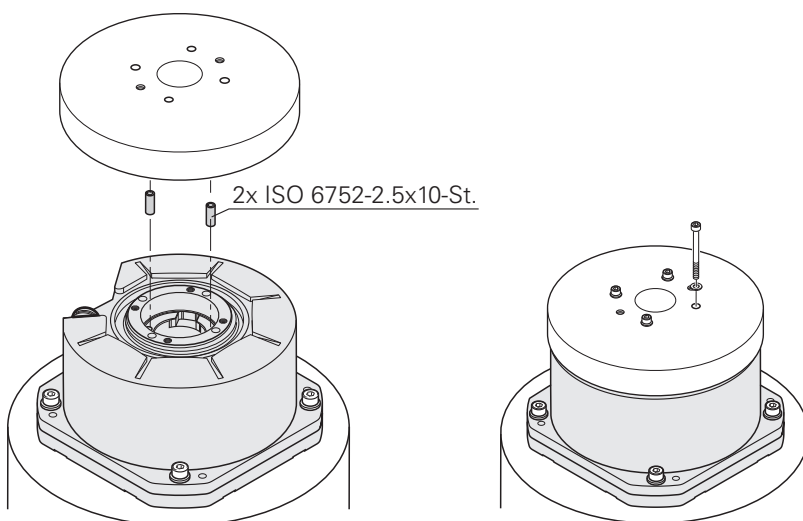
During mounting, the hollow shaft of the angle encoder is slid onto the machine shaft. The **catch** (ID 817921-01), which is attached to the front face of the encoder, implements the fault exclusion for the loosening of the mechanical connection between the encoder and the motor. Fastening is then accomplished with the ring nut (ID 336669-03); moment of inertia of ring nut and catch:  $4.8 \cdot 10^{-6} \text{ kgm}^2$ . It is easy to tighten with the help of the mounting tool.



Shaft coupling with ring nut and catch

## Front-face shaft coupling

Particularly in the case of rotary tables, it is often helpful to integrate the angle encoder into the table such that it is easily accessible when the rotor is detached. The hollow shaft is connected via the front-face threaded holes with the help of special mounting elements made for the given design (not included in delivery). In order for the radial runout and axial runout tolerances to be adhered to, the inside hole and plane surfaces must be used as mounting surfaces for the front-face shaft coupling. Fault exclusion for the loosening of the mechanical connection between the encoder and the motor is achieved with additional spring pins.



Front-face shaft coupling

## Materials to be used

The materials stated in this table must be used for the machine shaft and fastening components.

## Permissible angular accelerations for shaft coupling with mechanical fault exclusion

Based on where acceleration is applied and the type of mounting employed, the following values apply to angular acceleration:

- Permissible angular acceleration of the rotor with acceleration applied through the hollow shaft and shaft coupling with ring nut and catch:  $20000 \text{ rad/s}^2$
- Permissible angular acceleration of the rotor when acceleration is applied through the hollow shaft and a front-face shaft coupling with fastening screws and spring pins:  $5500 \text{ rad/s}^2$
- Permissible angular acceleration of the stator when acceleration is applied through the flange/housing:  $4000 \text{ rad/s}^2$

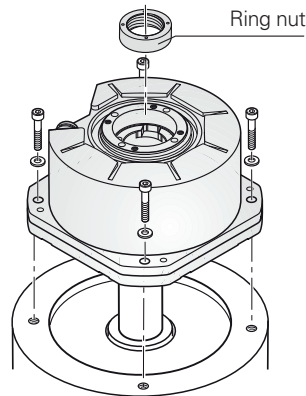
	Mating shaft	Mating stator
<b>Material</b>	Ferrous materials (steel/cast iron materials)	
<b>Tensile strength <math>R_m</math></b>	$\geq 600 \text{ N/mm}^2$	$\geq 250 \text{ N/mm}^2$
<b>Shear strength <math>\tau_B</math></b>	$\geq 390 \text{ N/mm}^2$	$\geq 290 \text{ N/mm}^2$
<b>Interface pressure <math>p_G</math></b>	$\geq 660 \text{ N/mm}^2$	$\geq 275 \text{ N/mm}^2$
<b>Young's modulus <math>E</math></b>	$110\,000 \text{ N/mm}^2$ to $215\,000 \text{ N/mm}^2$	
<b>Coefficient of thermal expansion <math>\alpha_{\text{therm}}</math> (at <math>20 \text{ }^\circ\text{C}</math>)</b>	$10 \cdot 10^{-6} \text{ K}^{-1}$ to $17 \cdot 10^{-6} \text{ K}^{-1}$	
<b>Mounting temperature</b>	All information regarding screw connections is based on a mounting temperature of $15 \text{ }^\circ\text{C}$ to $35 \text{ }^\circ\text{C}$	

# Mounting without mechanical fault exclusion

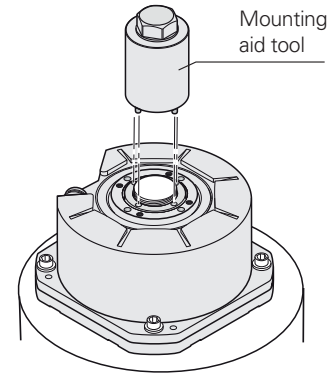
The housing of the RCN is firmly connected to the mounting surfaces of the machine component via a mounting flange and centering collar.

## Shaft coupling with ring nut

During mounting, the hollow shaft of the angle encoder is slid onto the machine shaft and fastened with a ring nut from the front face of the encoder. The ring nut (ID 336669-03) is easy to tighten with the help of the mounting tool (ID 530334-03).

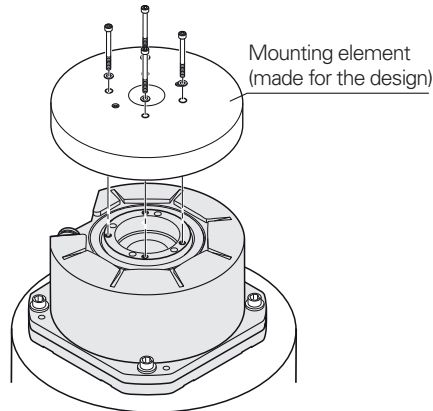


Shaft coupling with ring nut



## Front-face shaft coupling

The hollow shaft is connected via the front-face threaded holes with the help of special mounting elements made for the given design (not included in delivery). In order for the radial runout and axial runout tolerances to be adhered to, the inside hole and the plane surfaces must be used as mounting surfaces for the front-face shaft coupling.



Front-face shaft coupling

## Materials to be used

The materials stated in this table must be used for the machine shaft and fastening components.

	Mating shaft	Mating stator
<b>Material</b>	Ferrous materials (steel/cast iron materials)	
<b>Tensile strength <math>R_m</math></b>	$\geq 600 \text{ N/mm}^2$	$\geq 250 \text{ N/mm}^2$
<b>Shear strength <math>\tau_B</math></b>	$\geq 390 \text{ N/mm}^2$	$\geq 290 \text{ N/mm}^2$
<b>Interface pressure <math>p_G</math></b>	$\geq 660 \text{ N/mm}^2$	$\geq 275 \text{ N/mm}^2$
<b>Young's modulus E</b>	110 000 N/mm <sup>2</sup> to 215 000 N/mm <sup>2</sup>	
<b>Coefficient of thermal expansion <math>\alpha_{\text{therm}}</math></b> (at 20 °C)	10 · 10 <sup>-6</sup> K <sup>-1</sup> to 17 · 10 <sup>-6</sup> K <sup>-1</sup>	
<b>Mounting temperature</b>	All information regarding screw connections is based on a mounting temperature of 15 °C to 35 °C	

## Permissible angular accelerations

The permissible angular acceleration of the rotor and stator is 1000 rad/s<sup>2</sup>

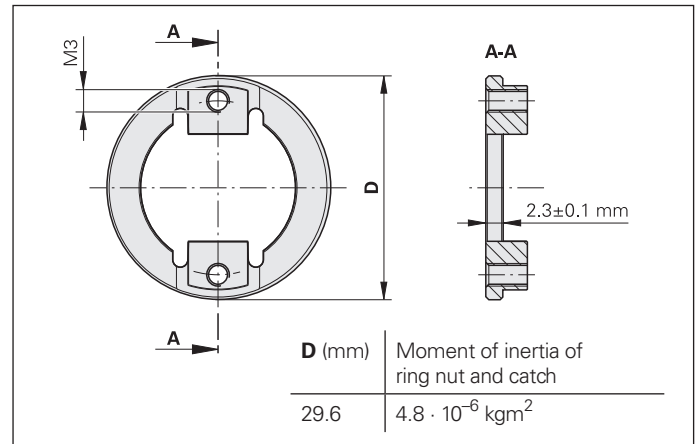
# Accessories

## Catch

In order to ensure mechanical fault exclusion for the loosening of the mechanical connection between the encoder and the machine shaft, a catch must be used for the shaft coupling via ring nuts.



Catch for the RCN 2001 series: ID 817921-01

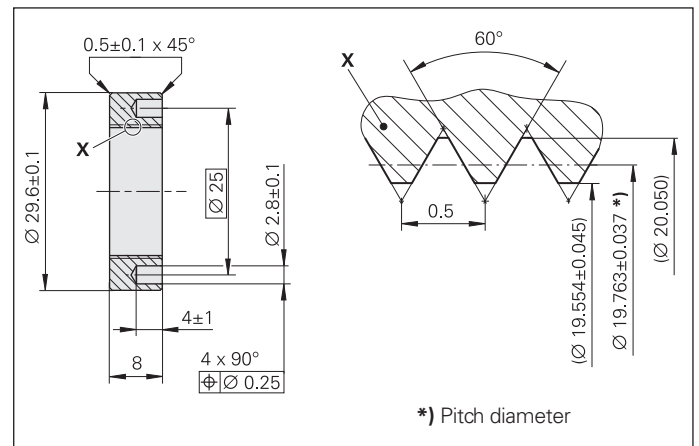


## Ring nut

For fastening of the shaft, HEIDENHAIN offers a special ring nut that smoothly rotates with the shaft thread and exhibits low axial play. This ensures that the load is evenly distributed on the shaft connection and prevents adverse loading on the angular encoder's hollow shaft.



Ring nut for the RCN 2001 series: ID 336669-03



## Mounting tool for HEIDENHAIN ring nut

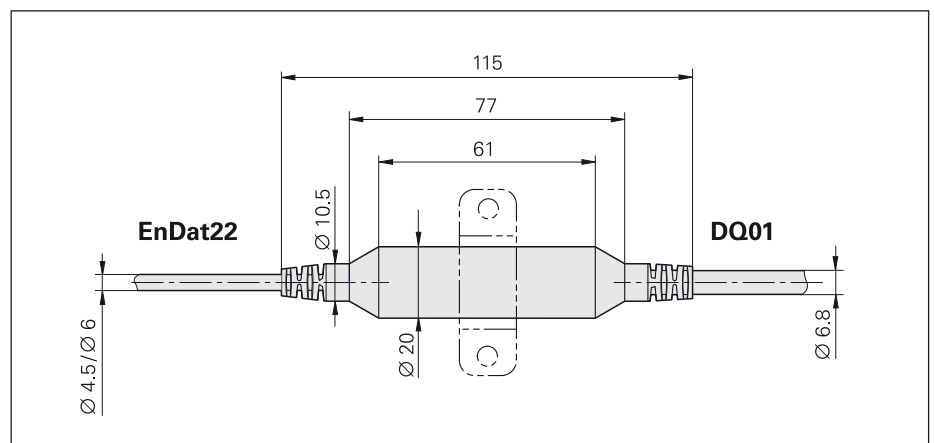
The mounting tool is used for tightening the ring nut. The tool's pins lock into the holes in the ring nut. A torque wrench allows the ring nuts to be tightened with the required tightening torque.



Mounting tool for ring nut: ID 530334-03






## EIB 3392 S external interface box in cable design

The EIB 3392S makes it possible to connect encoders with the "EnDat22" ordering designation to the DRIVE-CLiQ interface.








# Adapter cables and connecting cables





## EnDat adapter cables and connecting cable without incremental signals

<b>PUR adapter cables</b>		$\varnothing 4.5 \text{ mm}; 1 \times (4 \times 0.09 \text{ mm}^2) + 4 \times 0.16 \text{ mm}^2; A_P = 2 \times 0.16 \text{ mm}^2$
<b>Adapter cable</b> with 12-pin M12 quick connector and 8-pin M12 coupling (male)		729681-xx
<b>Adapter cable</b> with 12-pin M12 quick connector and 15-pin D-sub connector (female)		1119394-xx
<b>PUR adapter cables and connecting cable</b>		$\varnothing 6 \text{ mm}; 2 \times (2 \times 0.09 \text{ mm}^2) + 2 \times (2 \times 0.16 \text{ mm}^2); A_P = 2 \times 0.16 \text{ mm}^2$
<b>Adapter cable</b> with 8-pin M12 connector (female) and 15-pin D-sub connector (female)		1036521-xx
<b>Adapter cable</b> with 8-pin M12 connector (female) and 15-pin D-sub connector (male)		1036526-xx
<b>Connecting cable</b> with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		1036372-xx


## EnDat adapter cables and connecting cable with incremental signals

<b>Adapter cables</b>		$\varnothing 6 \text{ mm}; 6 \times (2 \times 0.19 \text{ mm}^2); A_P = 2 \times 0.19 \text{ mm}^2$
<b>Adapter cable</b> with 12-pin M12 quick connector and 17-pin M23 coupling (male)		643450-xx
<b>Adapter cable</b> with 12-pin M12 quick connector and 15-pin D-sub connector (female)		727658-xx
<b>PUR adapter cables and connecting cable</b>		$\varnothing 8 \text{ mm}; 4 \times (2 \times 0.16 \text{ mm}^2) + (4 \times 0.5 \text{ mm}^2 + 4 \times 0.16 \text{ mm}^2); A_P = 2 \times 0.5 \text{ mm}^2$
<b>Adapter cable</b> with 17-pin M23 connector (female) and 15-pin D-sub connector (female)		332115-xx
<b>Adapter cable</b> with 17-pin M23 connector (female) and 15-pin D-sub connector (male)		324544-xx
<b>Connecting cable</b> with 17-pin M23 connector (female) and stripped cable end		309778-xx

### Fanuc/Mitsubishi adapter cables and connecting cable

<b>PUR adapter cables</b> $\varnothing 4.5 \text{ mm}; (4 \times 0.09 \text{ mm}^2) + (4 \times 0.16 \text{ mm}^2); A_P = 2 \times 0.16 \text{ mm}^2$		<b>Fanuc</b>	<b>Mitsubishi</b>
<b>Adapter cable</b> with 12-pin M12 quick connector, 15-pin Mini Delta Ribbon connector (female) or 10-pin Mini Delta Ribbon connector (female)		1119918-xx	1119925-xx
<b>Adapter cable</b> with 12-pin M12 quick connector and 20-pin Mini Delta Ribbon connector (male)		–	1119920-xx
<b>Adapter cable</b> with 12-pin M12 quick connector and 8-pin M12 coupling (male)		729681-xx	
<b>PUR connecting cable</b> $\varnothing 6 \text{ mm}; 2 \times (2 \times 0.09 \text{ mm}^2) + 2 \times (2 \times 0.16 \text{ mm}^2); A_P = 2 \times 0.16 \text{ mm}^2$		<b>Fanuc</b>	<b>Mitsubishi</b>
<b>Connecting cable</b> with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		1036372-xx	

### Adapter cable between RCN 2001 and EIB 5200

<b>PUR adapter cable</b> $\varnothing 6 \text{ mm}; 4 \times (2 \times 0.09 \text{ mm}^2) + (4 \times 0.16 \text{ mm}^2); A_P = 2 \times 0.16 \text{ mm}^2$	
<b>Adapter cable</b> with 12-pin M12 quick connector, and 12-pin M12 coupling (male)	

$A_P$ : Cross section of power supply lines

$\varnothing$ : Cable diameter (for bend radii, see the *Interfaces of HEIDENHAIN Encoders* brochure)

**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.  
For more cables, see the *Cables and Connectors brochure*.

# Related documents



Brochure  
**Cables and Connectors**

Contents:  
Technical characteristics, cable overviews,  
and cable lists



Brochure  
**Interfaces of HEIDENHAIN Encoders**

Contents:  
Information on serial interfaces,  
sinusoidal signals, square-wave signals,  
and commutation signals



Brochure  
**Angle Encoders with Integral Bearing**

Contents:  
Absolute angle encoders  
**RCN, ECN, ROC**  
Incremental angle encoders  
**RON, RPN, ROD**



Brochure  
**Angle Encoder Modules**

Contents:  
Angle encoder modules  
**MRP 2000/MRP 5000/MRP 8000**  
Angle encoder modules with  
integrated torque motor  
**SRP 5000**



Brochure  
**Modular Angle Encoders  
with Optical Scanning**

Contents:  
Incremental angle encoders  
**ERP, ERO, ERA**  
Absolute angle encoders  
**ECA**



Brochure  
**Modular Angle Encoders  
with Magnetic Scanning**

Contents:  
Incremental encoders  
**ERM**

## HEIDENHAIN

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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 the correct operation:

- Brochure: *Angle Encoders with Integral Bearing* 591109-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Brochure: *Cables and Connectors* 1206103-xx
- Technical Information document: *Safety-Related Position Measuring Systems* 596632-xx
- Specification for safe control 533095-xx

For brochures and product information sheets, visit [www.heidenhain.de](http://www.heidenhain.de).