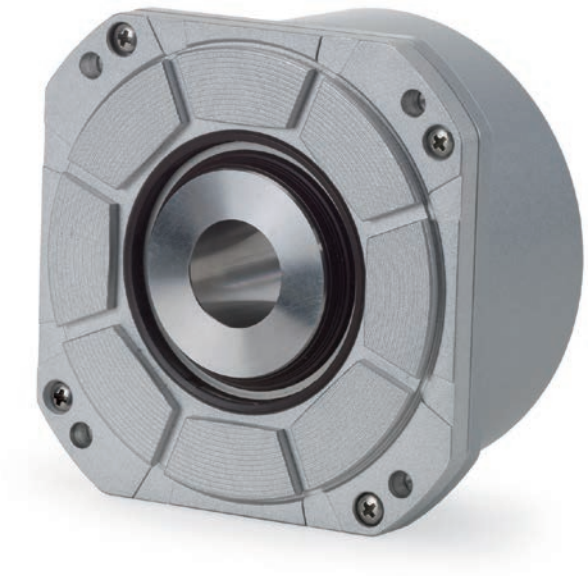
HEIDENHAIN

РЕМСТАНМАШ
ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

ООО «Ремстанмаш»
г. Смоленск, Верхне-Сенная, д.4, офис 223.
сайт. www.cnchelp.ru
Тел. 8-800-511-02-67
Тел. +7(499)704-02-67
Тел. 8-919-046-48-46 (WhatsApp, Viber)



Functional Safety

Product Information

RCN 2001
RCN 5001
RCN 8001

Absolute Angle Encoders
for High Productivity

03/2021

Angle encoders for direct drive motors in machine tools

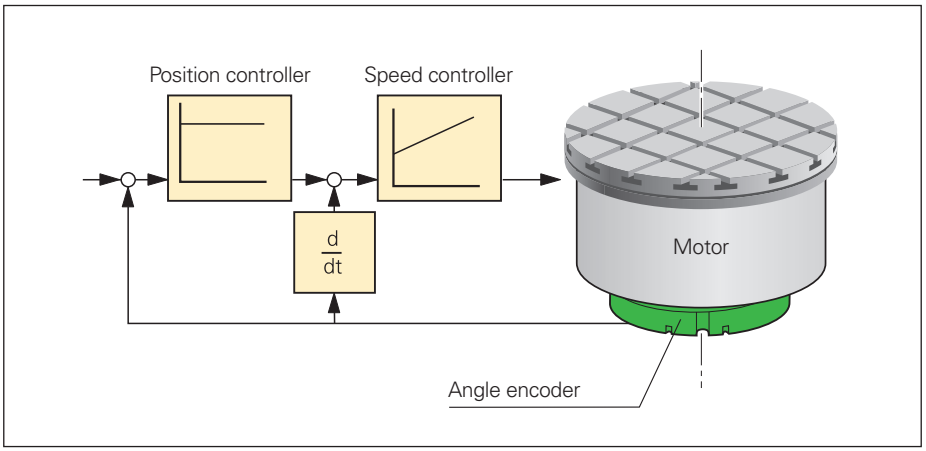
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Direct drive motors are being increasingly used in many fields, particularly in the machine tool industry. Compared with geared rotary axes, direct drive motors are extremely low wear and low maintenance. Without intervening mechanical transmission components, torque motors also enable significantly higher dynamic performance of the rotary axes. Thanks to their direct torque delivery, significantly higher accelerations and shaft speeds can be attained. This is particularly beneficial in 5-axis simultaneous machining, where it is typically the rotary axes that limit the speed of simultaneous motion. Higher dynamic performance of the rotary axes translates into uniform feed rates and increased productivity.

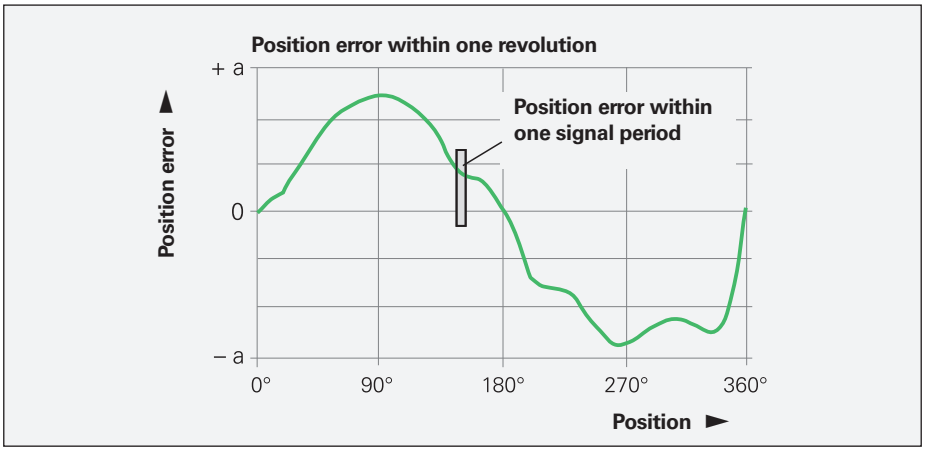
The performance of a direct-drive feed axis is significantly affected by the choice of encoder for measuring the axis position. Encoders employing the optical scanning method feature distinctive benefits for the accuracy, speed stability, and thermal behavior of a feed axis.

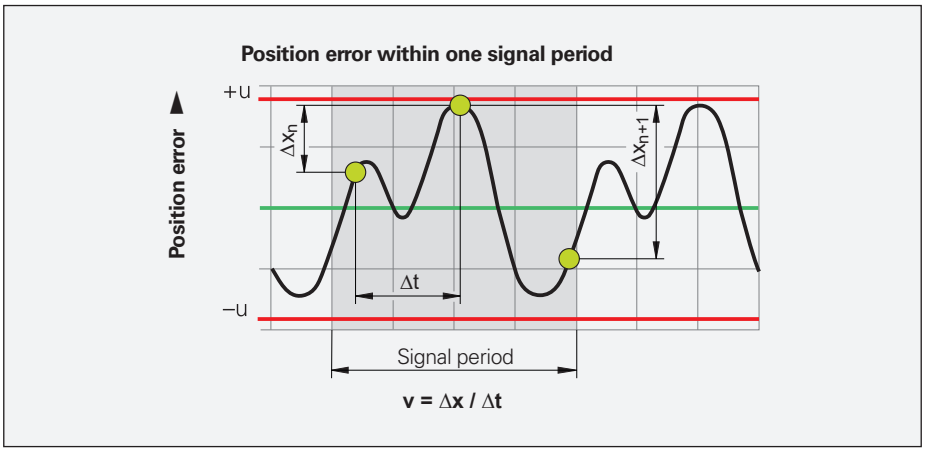
Along with the actual position, encoders in direct-drive feed axes also measure the current speed. Due to the absence of mechanical transmission elements between the encoder and the motor, these encoders must exhibit an accordingly high resolution in order to attain high-quality speed control at low feed rates.

Furthermore, higher k_V factors in the position control loop of direct drive motors permit larger control bandwidths and allow the 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 thus the rotary axis, reproduce the position errors within one signal period. Because direct drive motors exhibit a wider 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 a rotary direct drive motor (torque motor)

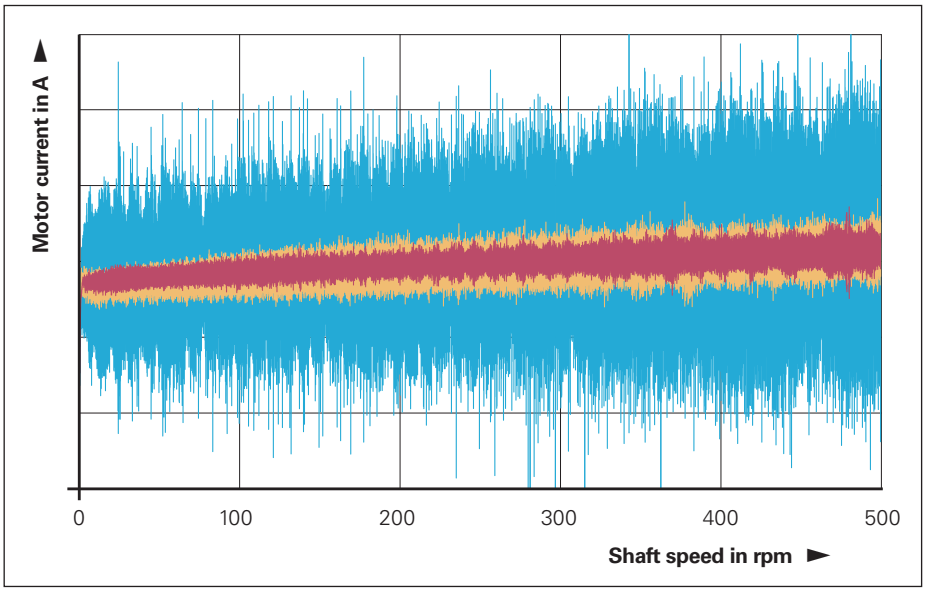




Position error within one signal period, with effects on speed stability

The speed controller calculates the nominal currents that brake or accelerate the motor in accordance with the control error. Inadequate encoder signal quality in the direct-drive axis causes disturbances in the position control loop and in the underlying control loops, extending as far 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. The loop gain must be reduced. The high noise also causes increased power dissipation in the motor. This results in greater heat build-up within the axis unit. Thermally induced deformations in the axis structure may arise, or greater machine cooling performance may be required. To avoid these problems, direct-drive feed axes call for position encoders with small signal periods and high signal quality.

A high line count and high signal quality are key characteristics of the RCN series. With these encoders, direct-drive rotary axes exhibit low motor current noise and smooth operating behavior. The high signal quality of optical encoders therefore permits better use of the performance potential of direct-drive feed axes.



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

- Optical angle encoder with 32 768 lines
- Optical angle encoder with 16 384 lines
- Non-optical angle encoder with 2600 lines

Benefits of the new RCN encoders compared with the predecessor models

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ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

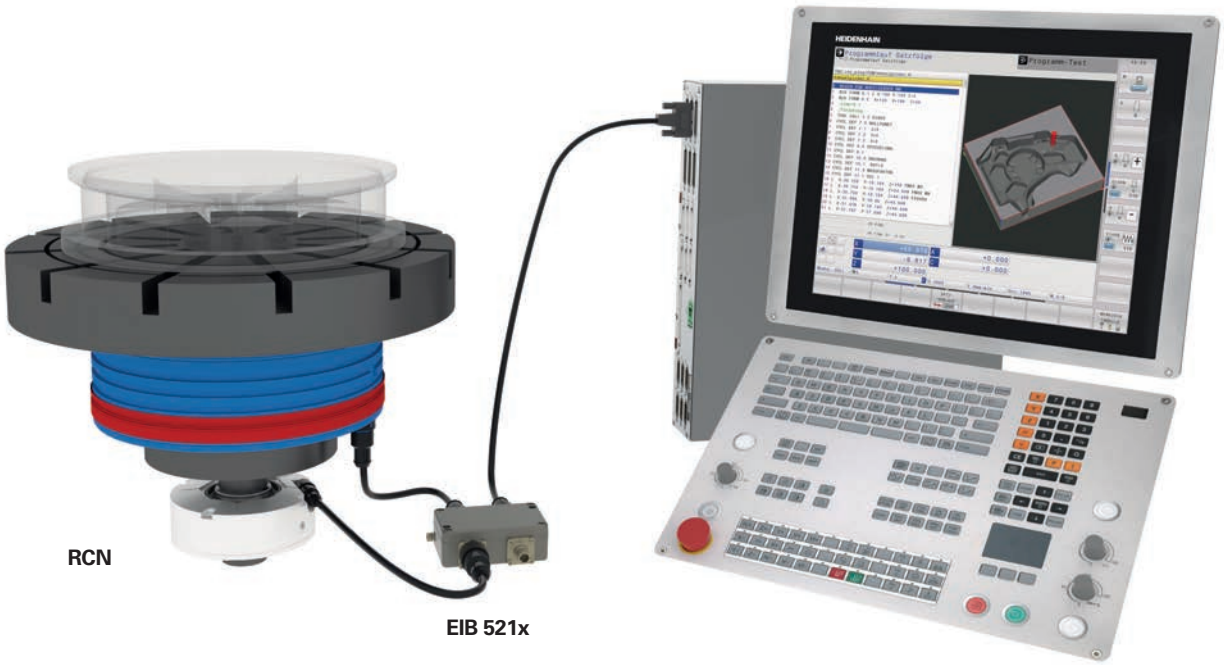
High system accuracy
Thanks to the optimization (e.g., of the scanning characteristics), the new RCN 2001 and RCN 5001 series are available in **system accuracies of ±2" and ±4"**.
At the same wide mounting tolerances as previously (e.g., up to ±0.3 mm axially), the system accuracy takes the following types of error into account:
- Position error within one revolution
- Position error within one signal period
- Coupling-induced error

The RCN 8001 series remains available in **system accuracies of ±1" and ±2"**.

Optimized scanning
The scanning performance of the RCN 2001, RCN 5001, and RCN 8001 is so forgiving that liquid contamination or drops of condensation have hardly any effect on the scanning signals and thus the motor control. This broadly prevents interruptions to the machining process due to encoder contamination.

Convenient measurement of the direct-drive motor temperature
To prevent the overheating of direct drive motors during operation, their temperature is typically monitored. When combined with the HEIDENHAIN EIB 5211 or EIB 5212 sensor box, the new series of encoders enable evaluation of the winding temperatures in direct drive motors. The sensor box is installed in close proximity to the direct drive motor and enables the digitalization of the **direct drive motor's temperature data** close to the application. The position data and the processed temperature data are transmitted to the control via the purely serial interface.

This yields the following practical benefits:
- Reduced cabling
- Purely digital transmission technology
- Overload protection of the direct drive motor by monitoring 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 by using the direct drive motor up to its thermal load limit



Combination of an RCN encoder and EIB 521x sensor box

DRIVE-CLiQ is a registered trademark of Siemens AG.

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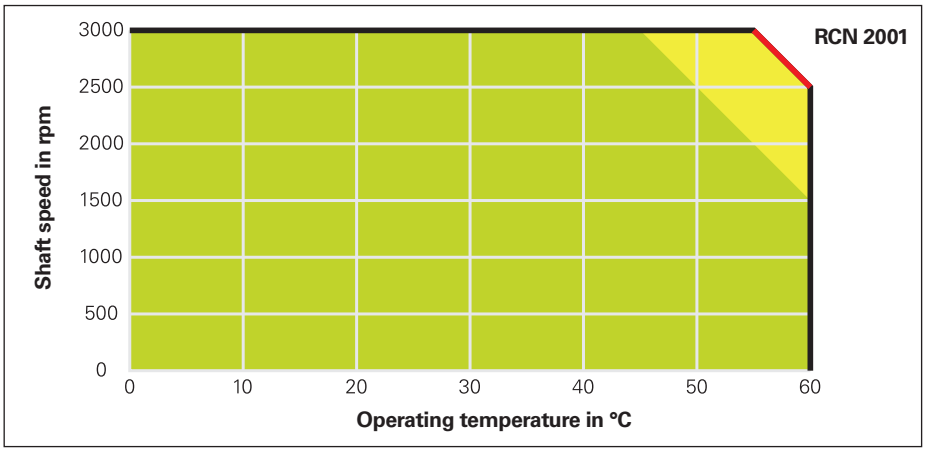
High permissible shaft speeds

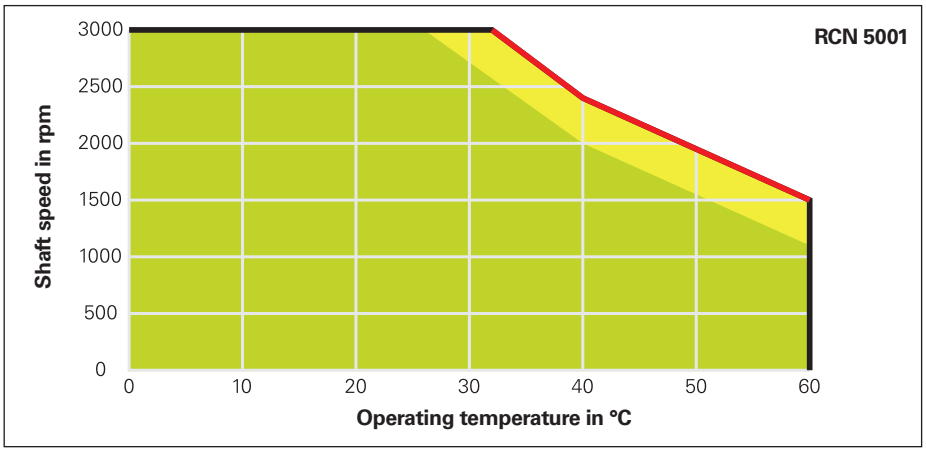
With a purely serial interface, shaft speeds of up to 3000 rpm are possible with the RCN 2001 and RCN 5001. Speeds of up to 1500 rpm are possible with the RCN 8001. The permissible speed largely depends on the internal encoder temperature, which is influenced by the operating time, temperature, and other factors. The operating temperature is defined as the temperature in the immediate vicinity of the encoder—but not at the encoder's surface. To protect the encoder from thermal overloads, the new RCN encoders are equipped with a temperature sensor. This sensor measures the temperature inside the encoder and transmits it to the subsequent electronics. If the temperature inside the encoder is too high (90 °C), then an alarm is generated, and the machine control initiates appropriate measures to protect the encoder from damage. When the EnDat interface is used and the temperature inside the encoder reaches 86 °C, a warning bit[1)] is set in advance. This bit can be used to trigger individualized machine actions and avoid interruption of the machining process. Speed diagrams were created through analyzing the encoder temperatures from tests at different operating temperatures and shaft speeds. The diagrams show the permissible shaft speeds as a function of the operating temperature (valid for up to 90 minutes of uninterrupted operation). As a function of the operating temperature, the green areas represent the permissible shaft speeds at which temperatures inside the encoder are non-critical. In the yellow areas, the combination of speed and operating temperature yield such a high encoder temperature from the outset that the EnDat interface generates a warning bit.[2)] At the red lines, the encoder temperature is 90 °C, and an alarm bit is set for an excessive temperature.

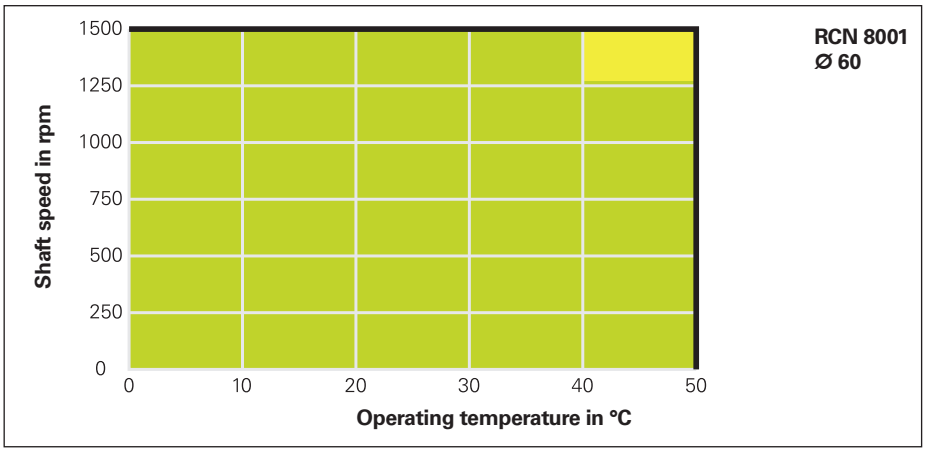
- Permissible speed range[3)]
- Enlarged speed range, requiring encoder temperature monitoring[3)]
- Specification limit (maximum permissible speed and operating temperature)[3)]
- Generation of an alarm bit due to excessive encoder temperature[3)]

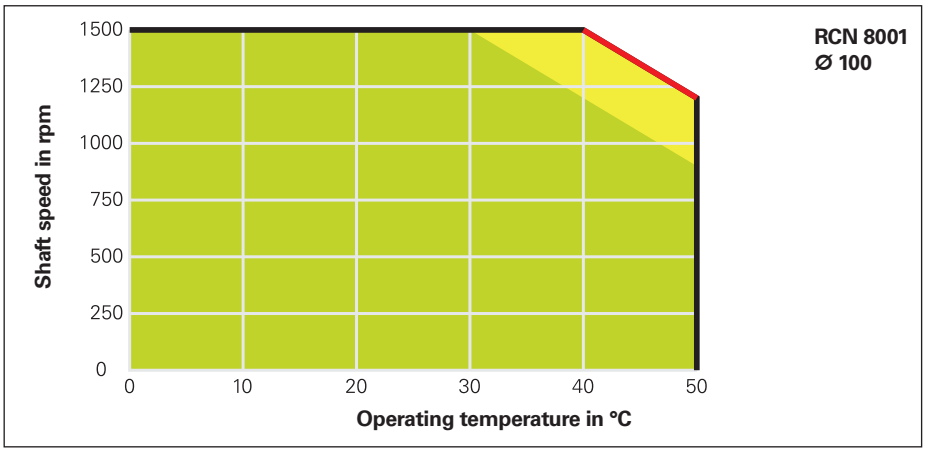
1) An alterable, pre-configured operating parameter
2) At a pre-configured temperature of 86 °C
3) With a purely serial interface

Speed diagrams as guidelines for the RCN series featuring a purely serial interface



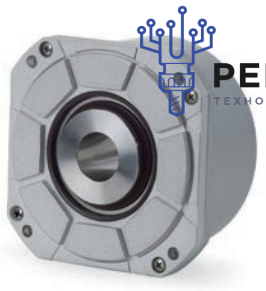


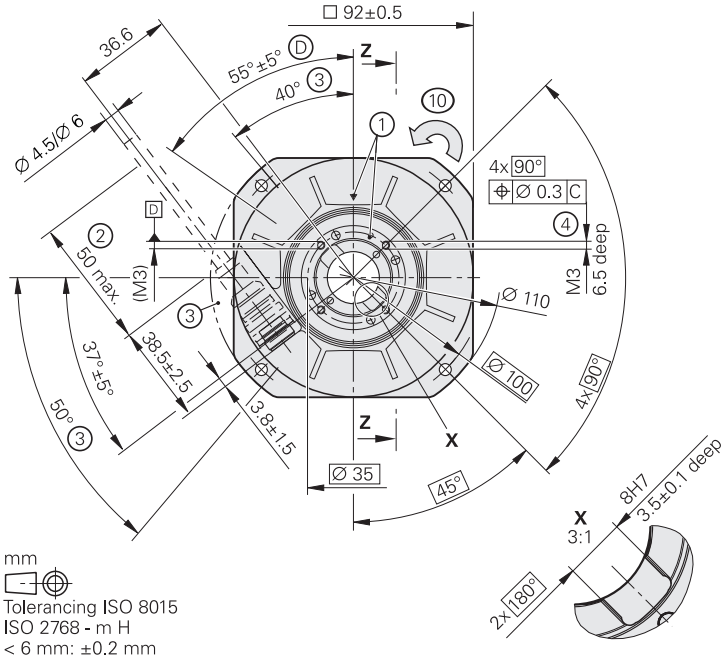


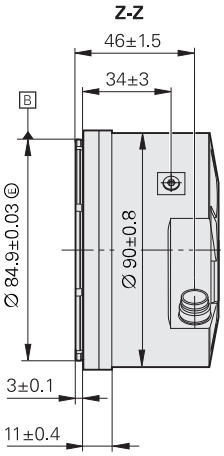


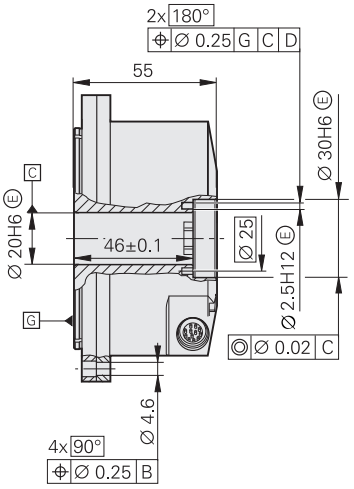
RCN 2001 series

Newest generation of absolute angle encoders
- **System accuracies: ±2″ and ±4″**
- **Transmission of the direct-drive motor temperature**
- **Integrated temperature sensor**
- **Suitability for high shaft speeds**
- **Hollow through shaft (Ø 20 mm)**



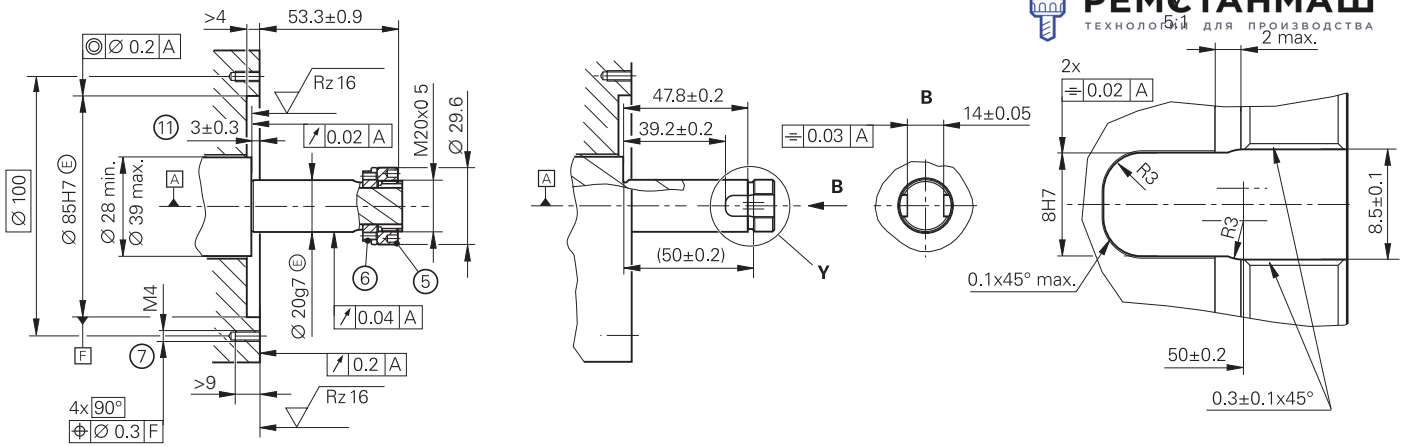




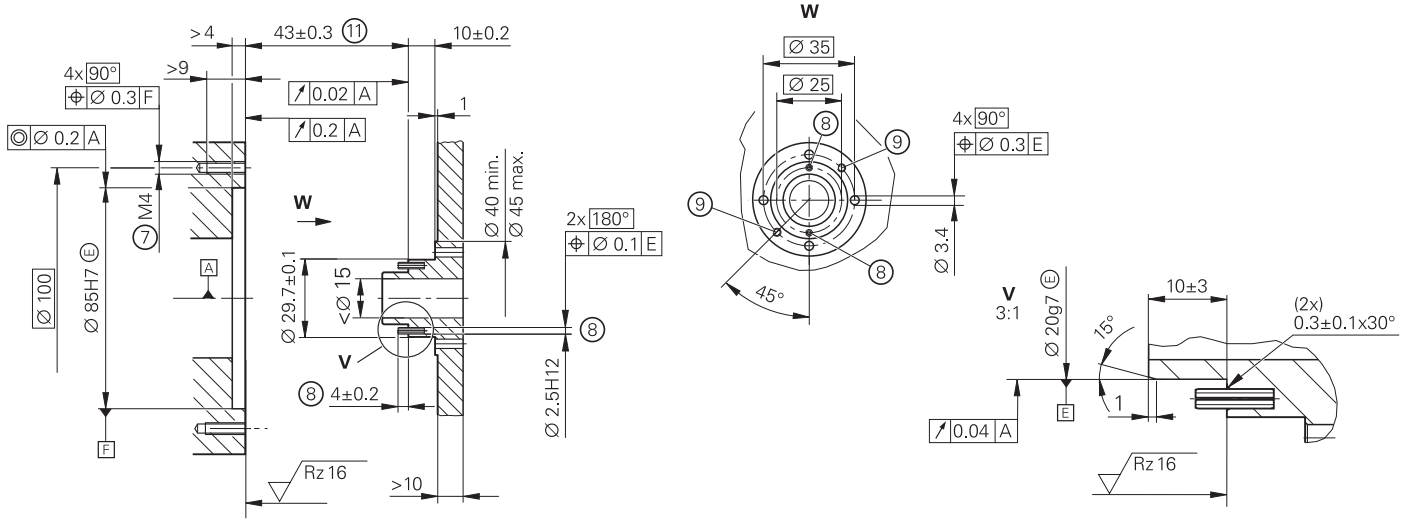


Ⓐ = Bearing of mating shaft
Ⓓ = Compressed air inlet
Ⓚ = Required mating dimensions
1 = Mark for 0° position ±5°
2 = Cable support
3 = Customer-side free space
4 = Thread engagement: 4.5 mm ±0.5 mm (for M3 cylinder head screws; for details, see the mounting instructions)
5 = Accessory: ring nut (ID 336669-03)
6 = Accessory: catch (ID 817921-01)
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 = Tolerance specification includes mounting tolerances and thermal expansion; no dynamic movement permitted

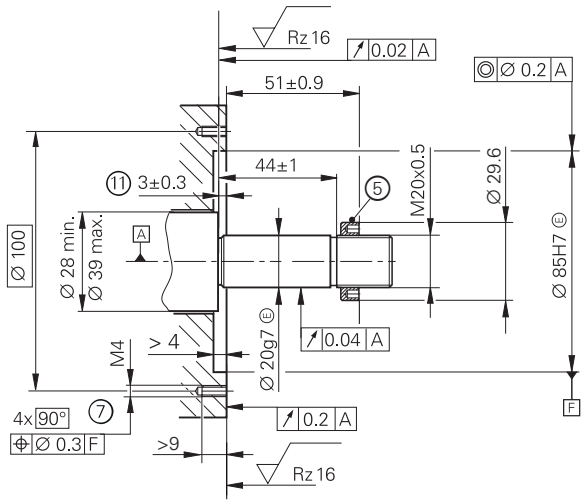
Shaft coupling with ring nut and catch (with mechanical fault exclusion) Ⓚ



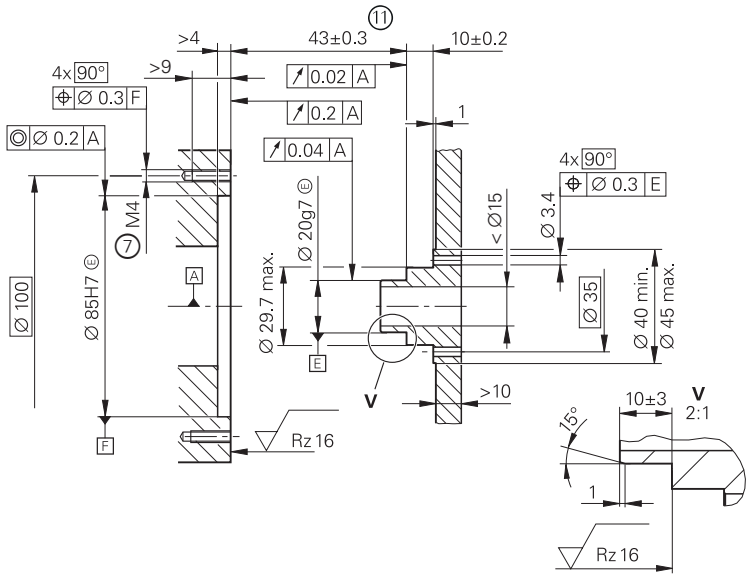
Front-face shaft coupling (with mechanical fault exclusion) Ⓚ



Shaft coupling with ring nut (without mechanical fault exclusion) Ⓚ



Front-face shaft coupling (without mechanical fault exclusion) Ⓚ



Specifications	*Absolute* RCN 2511	RCN 2311
Measuring standard	DIADUR circular scale with absolute track and incremental track (16 384 lines)	
System accuracy	±2″	±4″
Position error per signal period	≤ ±0.3″	≤ ±0.4″
Functional safety for applications with up to	• SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2015	
PFH	≤ $25 \cdot 10^{-9}$ (up to 2000 m above sea level)	
Safe position[1]	*Encoder:* ±0.22° (safety-related measuring step SM = 0.088°) *Mechanical coupling:* fault exclusions for the loosening of the housing/flange and hollow shaft (see *Functional safety* and *Mounting* on pages 22 and 23)	
Interface	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_{cal}	≤ 16 MHz ≤ 5 µs	
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[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W	
Current consumption (typical)	*5 V:* 140 mA (without load)	
Shaft	Hollow through shaft Ø 20 mm	
Mech. permiss. shaft speed (at constant speed for up to 90 min)	≤ 3000 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5)	
Starting torque (at 20 °C)	≤ 0.08 Nm (typical)	
Moment of inertia	*Rotor (hollow shaft):* $180 \cdot 10^{-6}$ kgm^2 *Stator (housing/flange):* $670 \cdot 10^{-6}$ kgm^2	
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)	
Natural frequency	≥ 1000 Hz	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)	
Operating temperature	0 °C to 60 °C	
Protection EN 60529	IP64	
Mass	≈ 1.1 kg	

[1] Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

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РЕМСТАНМАШ
ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

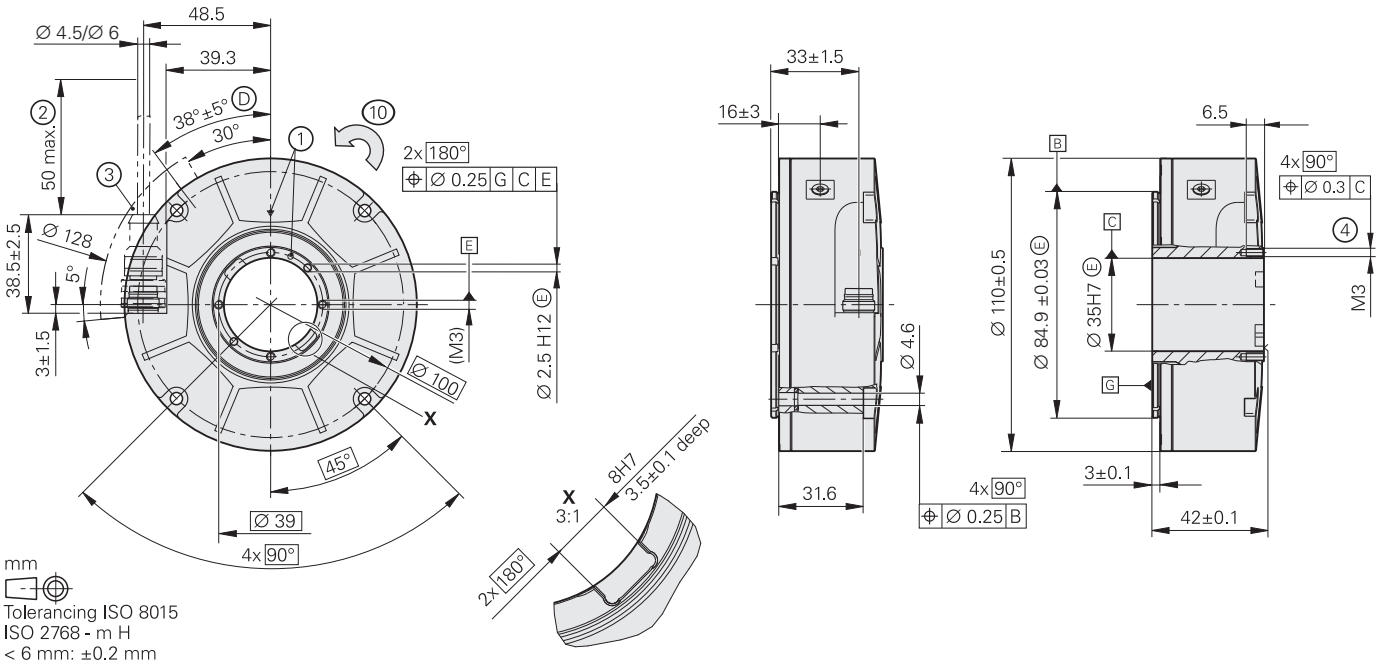
Specifications	*Absolute* RCN 2581 RCN 2381	RCN 2591 F RCN 2391 F	RCN 2591 M RCN 2391 M
Measuring standard	DIADUR circular scale with absolute track and incremental track (16 384 lines)		
System accuracy	*RCN 25x1:* ±2″ *RCN 23x1:* ±4″		
Position error per signal period	*RCN 2581:* ≤ ±0.4″ *RCN 2381:* ≤ ±0.4″	*RCN 25x1:* ≤ ±0.3″ *RCN 23x1:* ≤ ±0.4″	
Interface	EnDat 2.2	Fanuc Serial Interface αi interface[4]	Mitsubishi high speed interface
Ordering designation	EnDat02	Fanuc05	Mit03-4
Position values per rev.[4]	*RCN 25x1:* 268 435 456 (28 bits) *RCN 23x1:* 67 108 864 (26 bits)		
Electrically permissible speed	≤ 1500 rpm for continuous position values	≤ 3000 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 2 MHz ≤ 8 µs	–	
Incremental signals Cutoff frequency –3 dB	⁓ 1 V_{PP} ≥ 400 kHz	–	
Electrical connection	Separate adapter cable connectable to encoder via quick connector		
Cable length[1]	≤ 150 m	≤ 50 m	≤ 30 m
Supply voltage	DC 3.6 V to 14 V		
Power consumption[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W		
Current consumption (typical)	*5 V:* ≤ 140 mA (without load)		
Shaft	Hollow through shaft Ø 20 mm		
Mech. permiss. shaft speed (at constant speed for up to 90 min)	*RCN 2x91:* ≤ 3000 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5) *RCN 2x81:* ≤ 1500 rpm		
Starting torque (at 20 °C)	Typically ≤ 0.08 Nm		
Moment of inertia	*Rotor (hollow shaft):* 180 · 10^{-6} kgm^2 *Stator (housing/flange):* 670 · 10^{-6} kgm^2		
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)		
Natural frequency	≥ 1000 Hz		
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)		
Operating temperature	0 °C to 60 °C		
Protection EN 60529	IP64		
Mass	≈ 1.1 kg		

[1] With HEIDENHAIN cable ≤ 8 MHz
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted
[4] Reduced resolution during operation with the Fanuc α Interface; *RCN 2591 F:* 134 217 728 (27 bits)
RCN 2391 F: 8 388 608 (23 bits)

RCN 5001 series

Newest generation of absolute angle encoders
- **System accuracy ±2″ and ±4″**
- **Transmission of the direct-drive motor temperature**
- **Integrated temperature sensor**
- **Suitability for high shaft speeds**
- **Hollow through shaft (Ø 35 mm)**

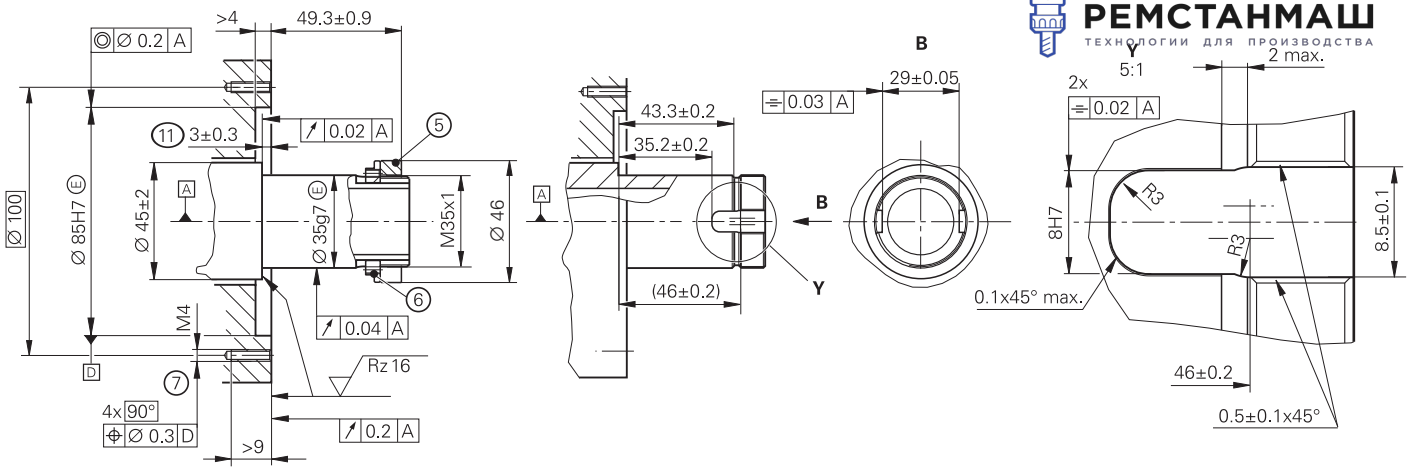




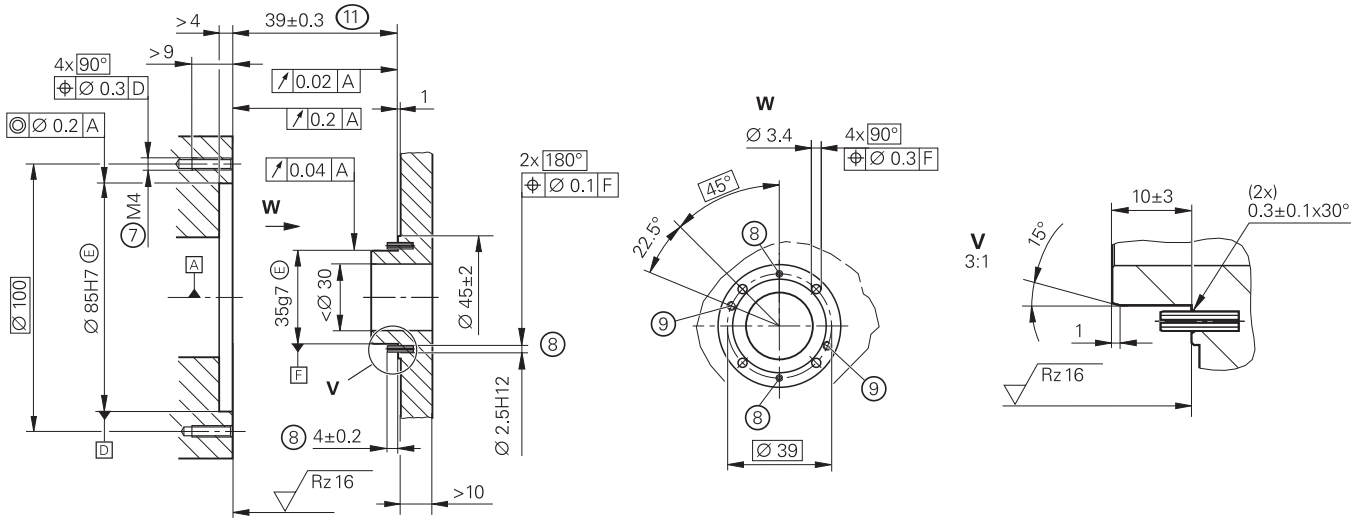
Ⓐ = Bearing of mating shaft
Ⓟ = Compressed air inlet
Ⓚ = Required mating dimensions
1 = Mark for 0° position ±5°
2 = Cable support
3 = Customer-side free space
4 = Thread engagement: 4.5 mm ±0.5 mm (for M3 cylinder head screws; for details, see the mounting instructions)
5 = Accessory: ring nut (ID 336669-17)
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

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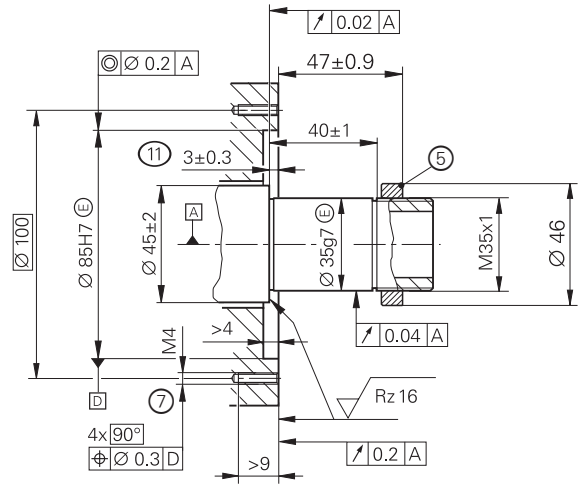
Shaft coupling with ring nut and catch (with mechanical fault exclusion) Ⓚ



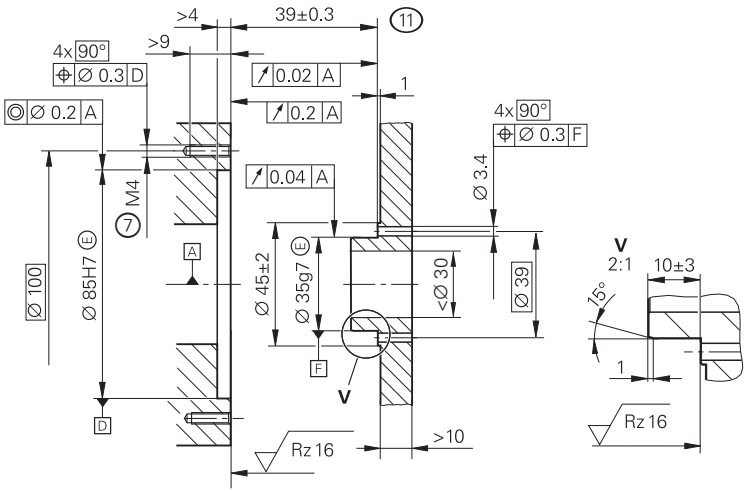
Front-face shaft coupling (with mechanical fault exclusion) Ⓚ



Shaft coupling with ring nut (without mechanical fault exclusion) Ⓚ



Front-face shaft coupling (without mechanical fault exclusion) Ⓚ



РЕМСТАНМАШ
ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

Specifications	*Absolute* RCN 5511 Functional Safety	RCN 5311 Functional Safety
Measuring standard	DIADUR circular scale with absolute track and incremental track (16 384 lines)	
System accuracy	±2″	±4″
Position error per signal period	≤ ±0.3″	≤ ±0.4″
Functional safety for applications with up to	• SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2015	
PFH	≤ $25 \cdot 10^{-9}$ (up to 2000 m above sea level)	
Safe position[1]	*Encoder:* ±0.22° (safety-related measuring step SM = 0.088°) *Mechanical coupling:* fault exclusions for the loosening of the housing/flange and hollow shaft (see *Functional safety* and *Mounting* on pages 22 and 23)	
Interface	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 values	
Clock frequency Calculation time t_{cal}	≤ 16 MHz ≤ 5 µs	
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[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W	
Current consumption (typical)	*5 V:* 140 mA (without load)	
Shaft	Hollow through shaft Ø = 35 mm	
Mech. permiss. shaft speed (at constant speed for up to 90 min)	≤ 2000 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5)	
Starting torque (at 20 °C)	≤ 0.2 Nm (typical)	
Moment of inertia	*Rotor (hollow shaft):* $130 \cdot 10^{-6}$ kgm^2 *Stator (housing/flange):* $1010 \cdot 10^{-6}$ kgm^2	
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)	
Natural frequency	≥ 1000 Hz	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)	
Operating temperature	0 °C to 60 °C	
Protection EN 60529	IP64	
Mass	≈ 0.9 kg	

[1] Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

РЕМСТАНМАШ
ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

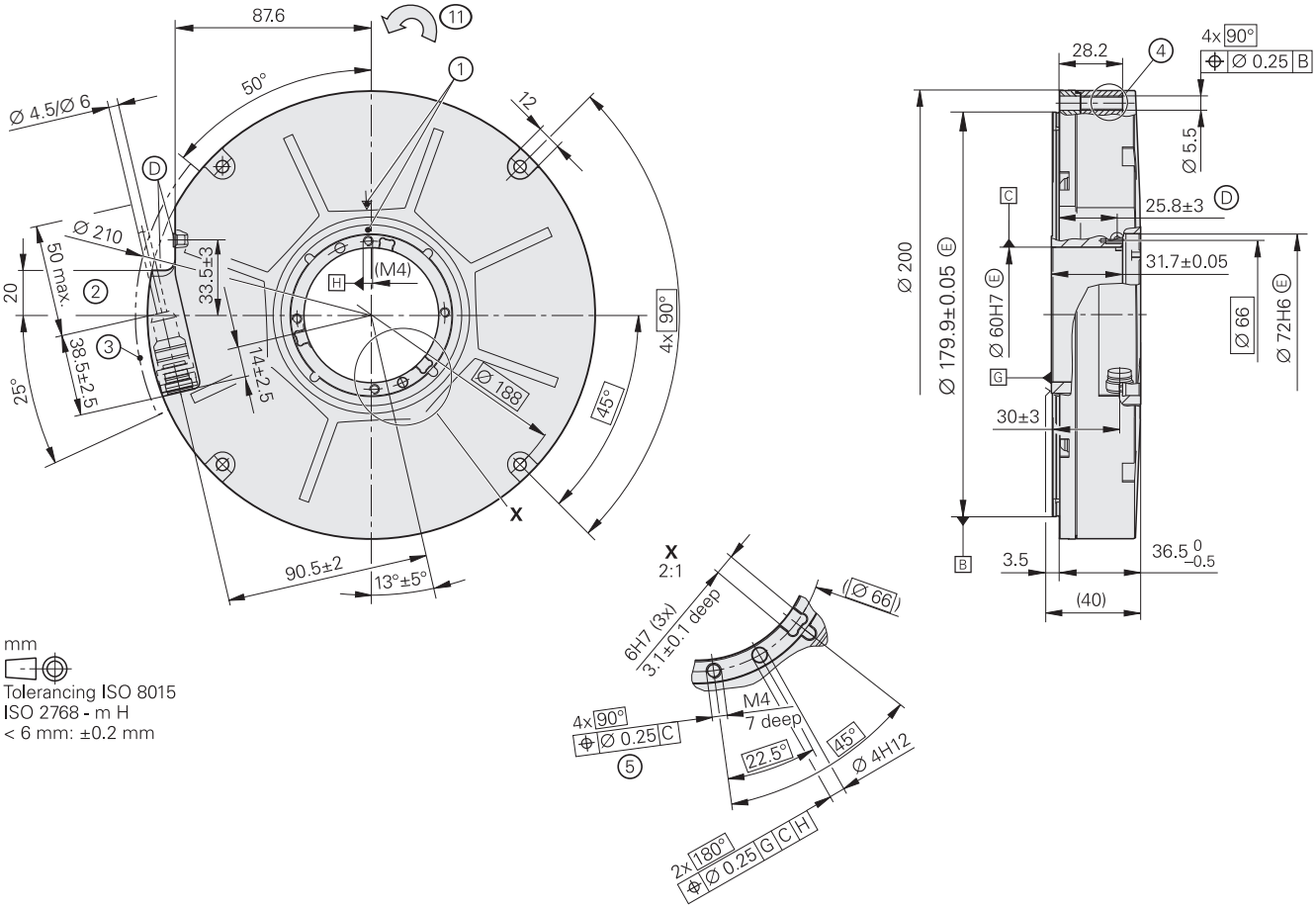
Specifications	*Absolute* **RCN 5581** **RCN 5381**	**RCN 5591 F** **RCN 5391 F**	**RCN 5591 M** **RCN 5391 M**
Measuring standard	DIADUR circular scale with absolute track and incremental track (16 384 lines)		
System accuracy	*RCN 55x1:* ±2″ *RCN 53x1:* ±4″		
Position error per signal period	*RCN 5581:* ≤ ±0.4″ *RCN 5381:* ≤ ±0.4″	*RCN 55x1:* ≤ ±0.3″ *RCN 53x1:* ≤ ±0.4″	
Interface	EnDat 2.2	Fanuc Serial Interface αi interface[4]	Mitsubishi high speed interface
Ordering designation	EnDat02	Fanuc05	Mit03-4
Position values per rev.[4]	*RCN 55x1:* 268 435 456 (28 bits) *RCN 53x1:* 67 108 864 (26 bits)		
Electrically permissible speed	≤ 1500 rpm for continuous position values	≤ 3000 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 2 MHz ≤ 8 µs	–	
Incremental signals Cutoff frequency –3 dB	⁓ 1 V_{PP} ≥ 400 kHz	–	
Electrical connection	Separate adapter cable connectable to encoder via quick connector		
Cable length[1]	≤ 150 m	≤ 50 m	≤ 30 m
Supply voltage	DC 3.6 V to 14 V		
Power consumption[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W		
Current consumption (typical)	*5 V:* ≤ 140 mA (without load)		
Shaft	Hollow through shaft Ø = 35 mm		
Mech. permiss. shaft speed (at constant speed for up to 90 min)	*RCN 5x91:* ≤ 2000 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5) *RCN 5x81:* ≤ 1500 rpm (operating temperature ≤ 50 °C) ≤ 1200 rpm (operating temperature > 50 °C)		
Starting torque (at 20 °C)	Typically ≤ 0.2 Nm		
Moment of inertia	*Rotor (hollow shaft):* 130 · 10^{-6} kgm^2 *Stator (housing/flange):* 1010 · 10^{-6} kgm^2		
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)		
Natural frequency	≥ 1000 Hz		
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)		
Operating temperature	0 °C to 60 °C		
Protection EN 60529	IP64		
Mass	≈ 0.9 kg		

[1] With HEIDENHAIN cable ≤ 8 MHz
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted
[4] Reduced resolution during operation with the Fanuc α Interface; *RCN 5591 F:* 134 217 728 (27 bits)
RCN 5391 F: 8 388 608 (23 bits)

RCN 8001 series



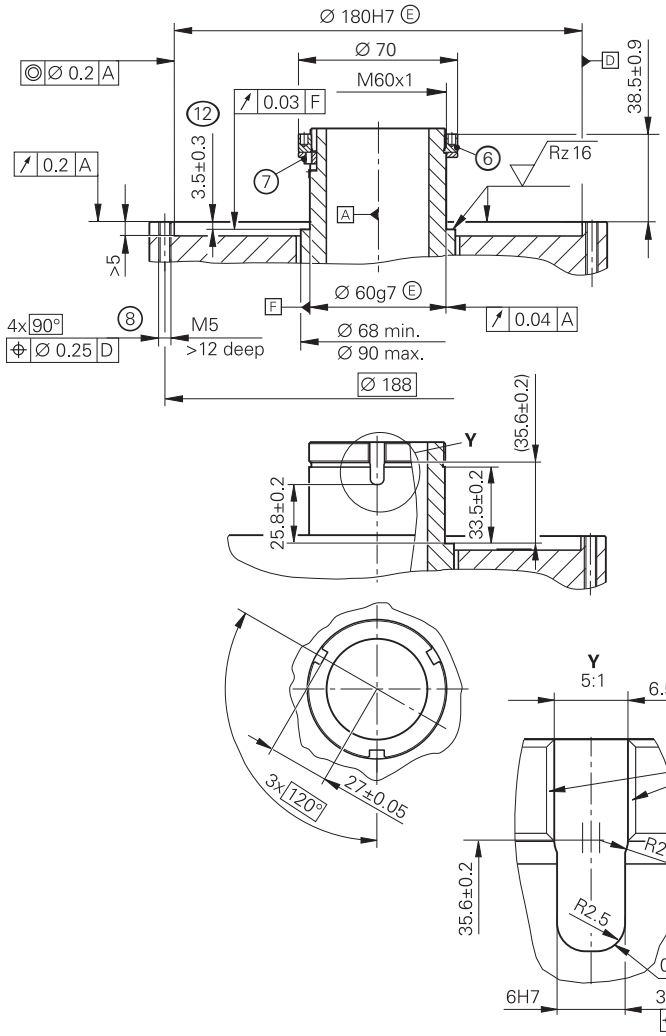
Newest generation of absolute angle encoders
- **System accuracy ±1″ and ±2″**
- **Transmission of the direct-drive motor temperature**
- **Integrated temperature sensor**
- **Suitability for high shaft speeds**
- **Hollow through shaft (Ø 60 mm)**



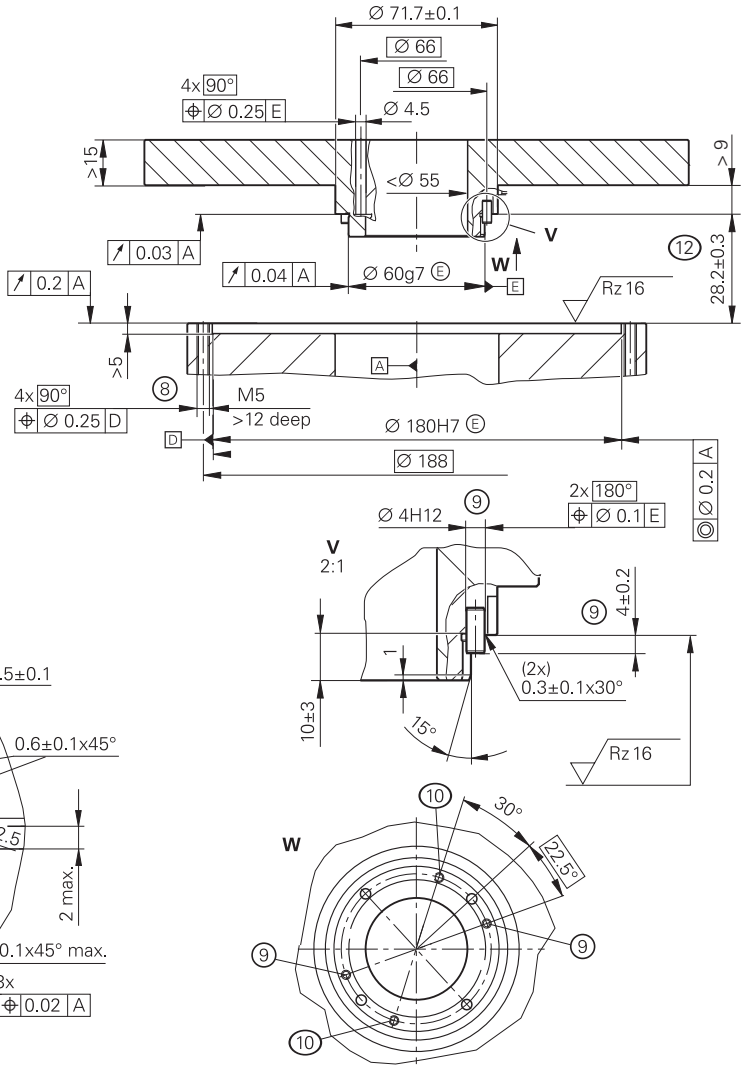
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

Ⓐ = 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 = Shown rotated by 45°
5 = Thread engagement: 5.5 mm ±0.5 mm (for M4 cylinder head screws; for details, see the mounting instructions)
6 = Accessory: ring nut (ID 336669-11)
7 = Accessory: catch (ID 817921-03)
8 = Thread engagement: 11 mm ±1 mm (for M5x40 cylinder head screws; for details, see mounting instructions)
9 = Two spring pins: ISO 8752 – 4x10 – St
10 = Provide additional M4 back-off thread if spring pins are used
11 = Direction of shaft rotation for ascending position values
12 = Stated tolerance includes mounting tolerances and thermal expansion; no dynamic movement permitted

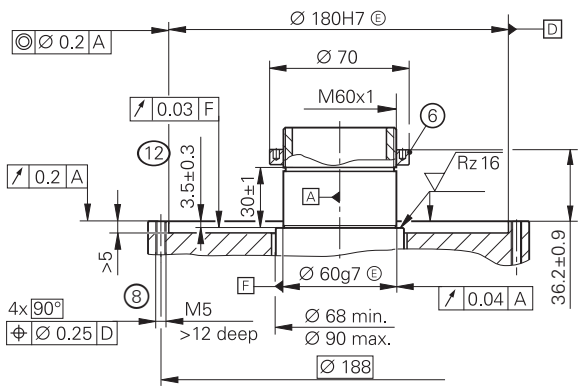
Shaft coupling with ring nut and catch (with mechanical fault exclusion) Ⓚ



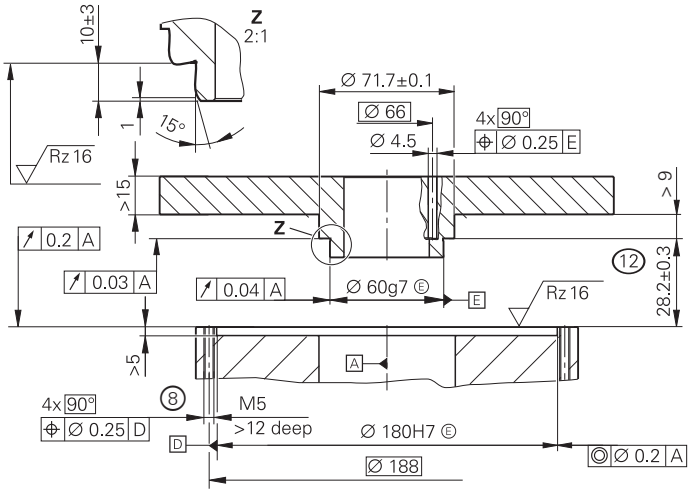
Front-face shaft coupling (with mechanical fault exclusion) Ⓚ



Shaft coupling with ring nut (without mechanical fault exclusion) Ⓚ



Front-face shaft coupling (without mechanical fault exclusion) Ⓚ



Specifications	*Absolute* RCN 8511	RCN 8311
Measuring standard	DIADUR circular scale with absolute track and incremental track (32 768 lines)	
System accuracy	±1″	±2″
Position error per signal period	≤ ±0.15″	≤ ±0.2″
Functional safety for applications with up to	• SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2015	
PFH	≤ $25 \cdot 10^{-9}$ (up to 2000 m above sea level)	
Safe position[1]	*Encoder:* ±0.11° (safety-related measuring step SM = 0.044°) *Mechanical coupling:* fault exclusions for the loosening of the housing/flange and hollow shaft (see *Functional safety* and *Mounting* on pages 22 and 23)	
Interface	EnDat 2.2	
Ordering designation	EnDat22	
Positions per revolution	536 870 912 (29 bits)	
Electrically permissible speed	≤ 1500 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 16 MHz ≤ 5 µs	
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[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W	
Current consumption (typical)	*5 V:* 140 mA (without load)	
Shaft	Hollow through shaft Ø = 60 mm	
Mech. permiss. shaft speed (at constant speed for up to 90 min)	≤ 1500 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5)	
Starting torque (at 20 °C)	≤ 0.7 Nm (typical)	
Moment of inertia	*Rotor (hollow shaft):* $1.22 \cdot 10^{-3}$ kgm^2 *Stator (housing/flange):* $11 \cdot 10^{-3}$ kgm^2	
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)	
Natural frequency	≥ 900 Hz	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)	
Operating temperature	0 °C to 50 °C	
Protection EN 60529	IP64	
Mass	≈ 2.8 kg	

[1] Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

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ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

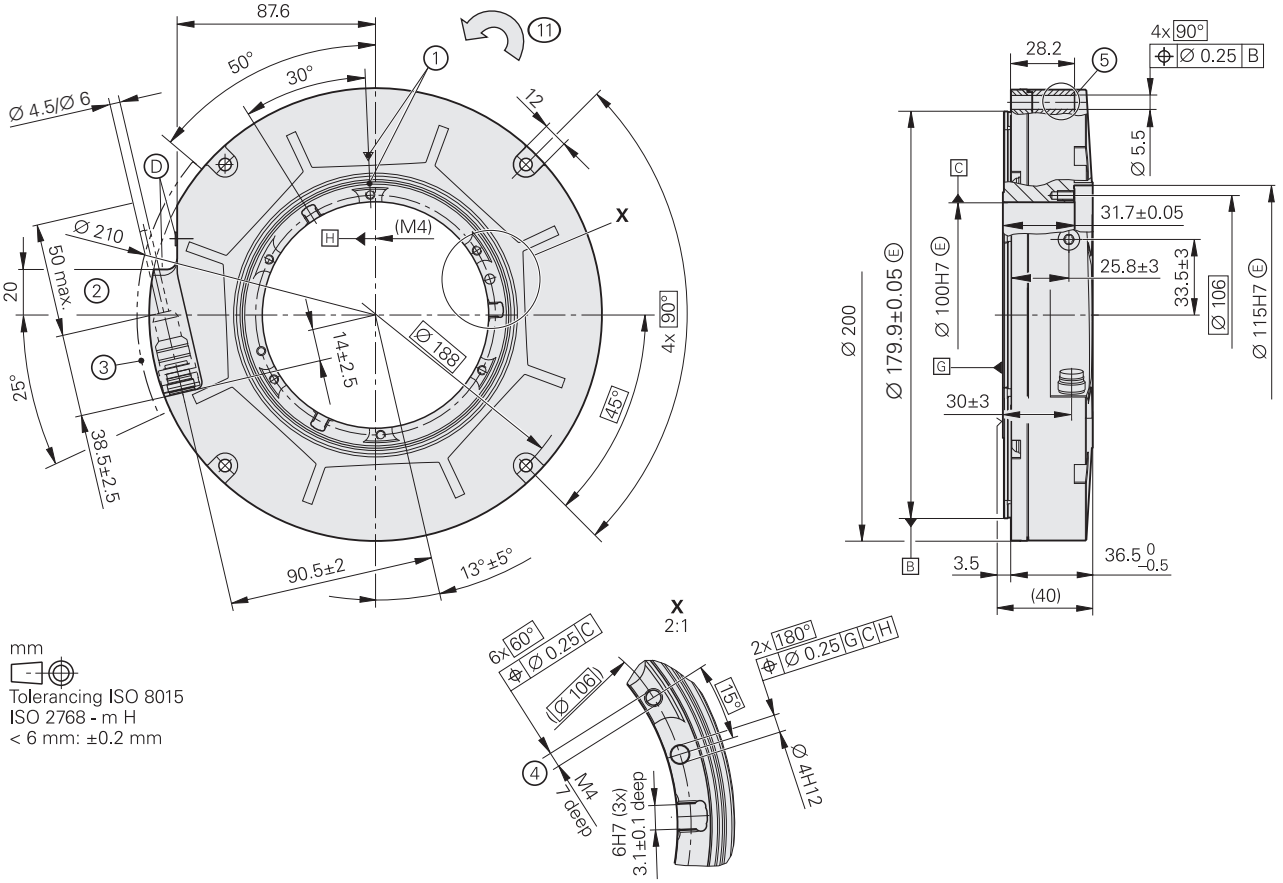
Specifications	*Absolute* **RCN 8581** **RCN 8381**	**RCN 8591 F** **RCN 8391 F**	**RCN 8591 M** **RCN 8391 M**
Measuring standard	DIADUR circular scale with absolute track and incremental track (32 768 lines)		
System accuracy	*RCN 85x1:* ±1″ *RCN 83x1:* ±2″		
Position error per signal period	*RCN 8581:* ≤ ±0.2″ *RCN 8381:* ≤ ±0.2″	*RCN 85x1:* ≤ ±0.15″ *RCN 83x1:* ≤ ±0.2″	
Interface	EnDat 2.2	Fanuc Serial Interface αi interface[4]	Mitsubishi high speed interface
Ordering designation	EnDat02	Fanuc05	Mit03-4
Position values per rev.[4]	536 870 912 (29 bits)		
Electrically permissible speed	≤ 750 rpm for continuous position values	≤ 1500 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 2 MHz ≤ 8 µs	–	
Incremental signals Cutoff frequency –3 dB	⁓ 1 V_{PP} ≥ 400 kHz	–	
Electrical connection	Separate adapter cable connectable to encoder via quick connector		
Cable length[1]	≤ 150 m	≤ 50 m	≤ 30 m
Supply voltage	DC 3.6 V to 14 V		
Power consumption[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W		
Current consumption (typical)	*5 V:* ≤ 140 mA (without load)		
Shaft	Hollow through shaft Ø = 60 mm		
Mech. permiss. shaft speed (at constant speed for up to 90 min)	*RCN 8x91:* ≤ 1500 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5) *RCN 8x81:* ≤ 750 rpm		
Starting torque (at 20 °C)	Typically ≤ 0.7 Nm		
Moment of inertia	*Rotor (hollow shaft):* 1.22 · 10^{-3} kgm^2 *Stator (housing/flange):* 11 · 10^{-3} kgm^2		
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)		
Natural frequency	≥ 900 Hz		
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)		
Operating temperature	0 °C to 50 °C		
Protection EN 60529	IP64		
Mass	≈ 2.8 kg		

[1] With HEIDENHAIN cable ≤ 8 MHz
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted
[4] Reduced resolution during operation with the Fanuc α Interface; *RCN 8x91 F:* 134 217 728 (27 bits)

RCN 8001 series

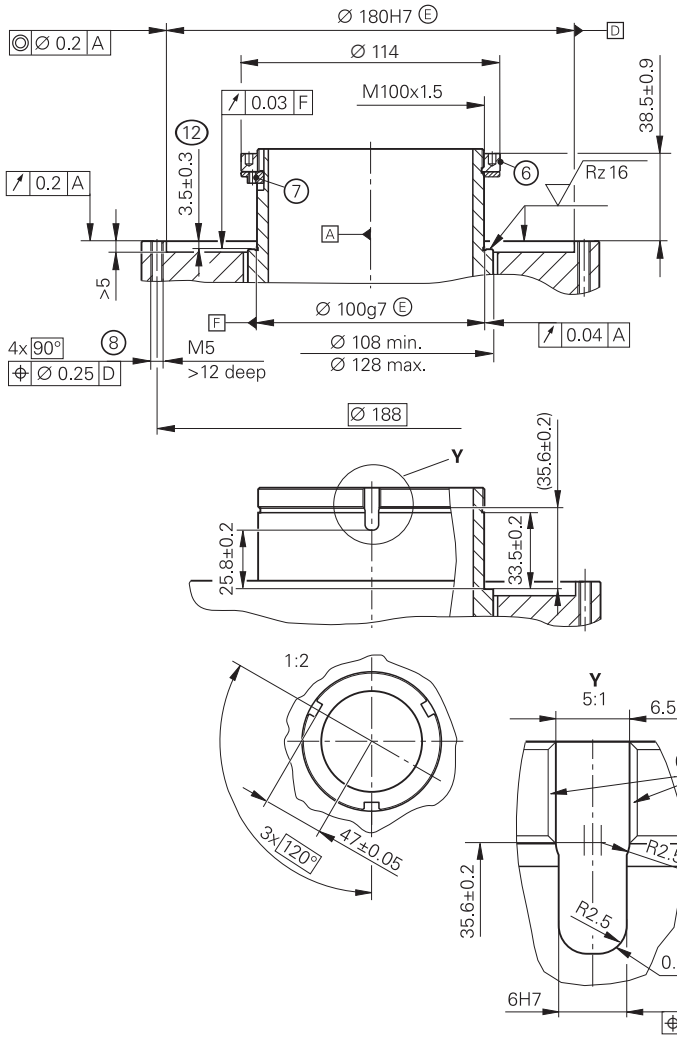
Newest generation of absolute angle encoders
- **System accuracy ±2″ and ±4″**
- **Transmission of the direct-drive motor temperature**
- **Integrated temperature sensor**
- **Suitability for high shaft speeds**
- **Hollow through shaft (Ø 100 mm)**



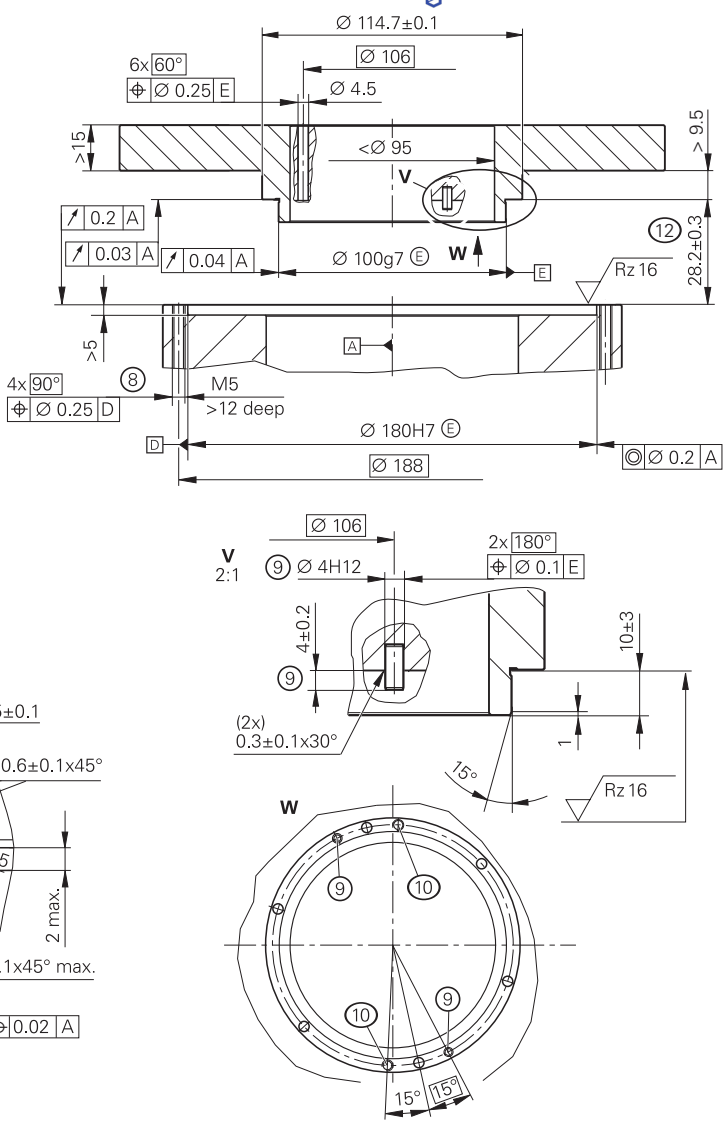


A = Bearing of mating shaft
D = Compressed air inlet
K = Required mating dimensions
1 = Mark for 0° position ±5°
2 = Cable support
3 = Customer-side free space
4 = Thread engagement: 5.5 mm ±0.5 mm (for M4 cylinder head screws; for details, see the mounting instructions)
5 = Shown rotated by 45°
6 = Accessory: ring nut (ID 336669-16)
7 = Accessory: catch (ID 817921-04)
8 = Thread engagement: 11 mm ±1 mm (for M5 cylinder head screws; for details, see the mounting instructions)
9 = Two spring pins: ISO 8752 – 4x10 – St
10 = Provide additional M4 back-off thread if spring pins are used
11 = Direction of shaft rotation for ascending position values
12 = Stated tolerance includes mounting tolerances and thermal expansion; no dynamic movement permitted

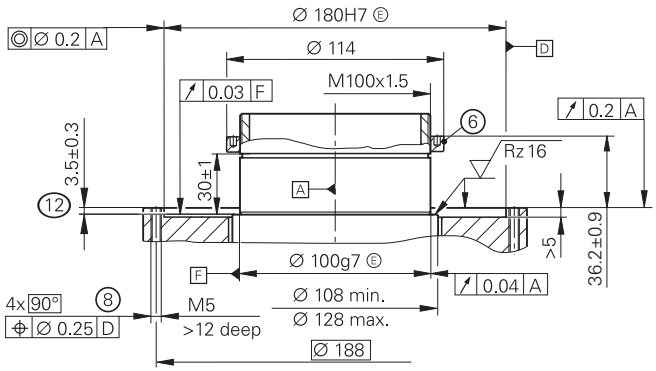
Shaft coupling with ring nut and catch (with mechanical fault exclusion) Ⓚ



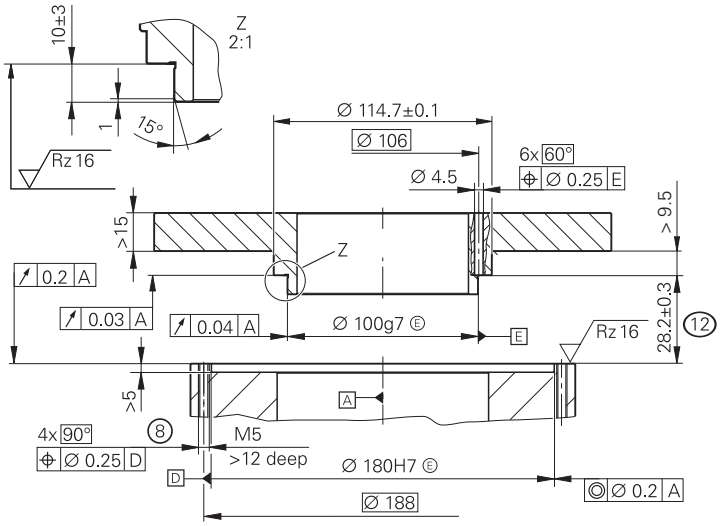
Front-face shaft coupling (with mechanical fault exclusion) Ⓚ



Shaft coupling with ring nut (without mechanical fault exclusion) Ⓚ



Front-face shaft coupling (without mechanical fault exclusion) Ⓚ



Specifications	*Absolute* RCN 8511	RCN 8311
Measuring standard	DIADUR circular scale with absolute track and incremental track (32 768 lines)	
System accuracy	±1″	±2″
Position error per signal period	≤ ±0.15″	≤ ±0.2″
Functional safety for applications with up to	• SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2015	
PFH	≤ $25 \cdot 10^{-9}$ (up to 2000 m above sea level)	
Safe position[1]	*Encoder:* ±0.11° (safety-related measuring step SM = 0.044°) *Mechanical coupling:* fault exclusions for the loosening of the housing/flange and hollow shaft (see *Functional safety* and *Mounting* on pages 22 and 23)	
Interface	EnDat 2.2	
Ordering designation	EnDat22	
Positions per revolution	536 870 912 (29 bits)	
Electrically permissible speed	≤ 1500 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 16 MHz ≤ 5 µs	
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[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W	
Current consumption (typical)	*5 V:* 140 mA (without load)	
Shaft	Hollow through shaft Ø = 100 mm	
Mech. permiss. shaft speed (at constant speed for up to 90 min)	≤ 1200 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5)	
Starting torque (at 20 °C)	≤ 1.0 Nm (typical)	
Moment of inertia	*Rotor (hollow shaft):* $3.2 \cdot 10^{-3}$ kgm^2 *Stator (housing/flange):* $10 \cdot 10^{-3}$ kgm^2	
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)	
Natural frequency	≥ 900 Hz	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)	
Operating temperature	0 °C to 50 °C	
Protection EN 60529	IP64	
Mass	≈ 2.6 kg	

[1] Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted

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Specifications	*Absolute* RCN 8581 RCN 8381	RCN 8591 F RCN 8391 F	RCN 8591 M RCN 8391 M
Measuring standard	DIADUR circular scale with absolute track and incremental track (32 768 lines)		
System accuracy	*RCN 85x1:* ±1″ *RCN 83x1:* ±2″		
Position error per signal period	*RCN 8581:* ≤ ±0.2″ *RCN 8381:* ≤ ±0.2″	*RCN 85x1:* ≤ ±0.15″ *RCN 83x1:* ≤ ±0.2″	
Interface	EnDat 2.2	Fanuc Serial Interface αi interface[4]	Mitsubishi high speed interface
Ordering designation	EnDat02	Fanuc05	Mit03-4
Position values per rev.[4]	536 870 912 (29 bits)		
Electrically permissible speed	≤ 750 rpm for continuous position values	≤ 1500 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 2 MHz ≤ 8 µs	–	
Incremental signals Cutoff frequency –3 dB	⁓ 1 V_{PP} ≥ 400 kHz	–	
Electrical connection	Separate adapter cable connectable to encoder via quick connector		
Cable length[1]	≤ 150 m	≤ 50 m	≤ 30 m
Supply voltage	DC 3.6 V to 14 V		
Power consumption[2] (maximum)	*3.6 V:* ≤ 1.1 W *14 V:* ≤ 1.3 W		
Current consumption (typical)	*5 V:* ≤ 140 mA (without load)		
Shaft	Hollow through shaft Ø = 100 mm		
Mech. permiss. shaft speed (at constant speed for up to 90 min)	*RCN 8x91:* ≤ 1200 rpm (at an operating temperature of 40 °C; for details, see *High permissible shaft speeds* on page 5) *RCN 8x81:* ≤ 750 rpm		
Starting torque (at 20 °C)	Typically ≤ 1.0 Nm		
Moment of inertia	*Rotor (hollow shaft):* $3.2 \cdot 10^{-3}$ kgm^2 *Stator (housing/flange):* $10 \cdot 10^{-3}$ kgm^2		
Permissible axial motion of measured shaft	*Axial:* ±0.3 mm[3] *Radial:* Ø 0.2 mm for coaxiality and, during operation, 0.04 mm for radial runout (each relative to the bearing axis of the mating shaft)		
Natural frequency	≥ 900 Hz		
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27)		
Operating temperature	0 °C to 50 °C		
Protection EN 60529	IP64		
Mass	≈ 2.6 kg		

[1] With HEIDENHAIN cable ≤ 8 MHz
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Range includes mounting tolerances and thermal expansion; no dynamic movement permitted
[4] Reduced resolution during operation with the Fanuc α Interface; *RCN 8x91 F:* 134 217 728 (27 bits)

Functional safety

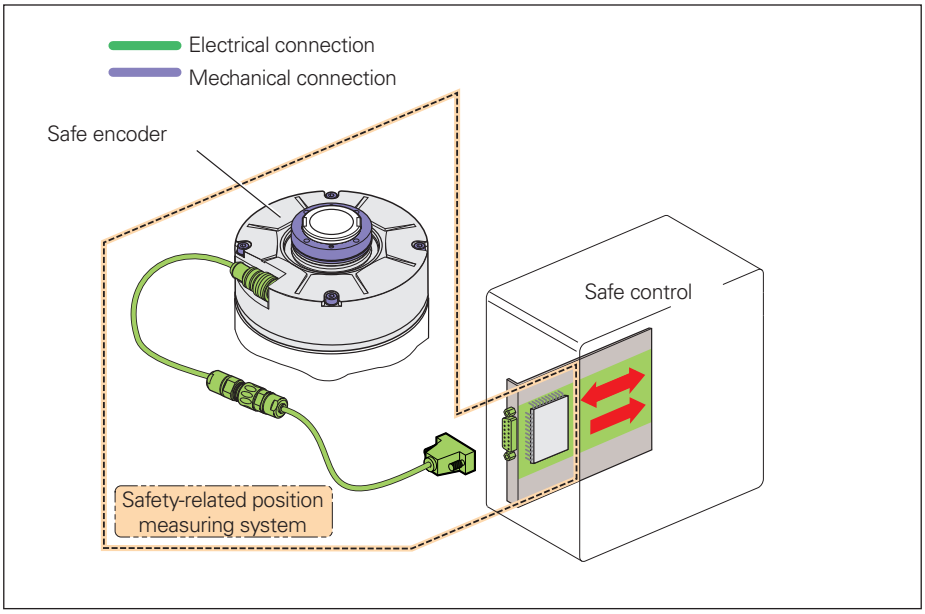
With the RCN 2001/5001/8001 series of absolute angle encoders, HEIDENHAIN offers the ideal solution for position acquisition on rotary axes in safety-related applications. In conjunction with a safe control, these encoders can be used as single-encoder systems in applications with control category SIL 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 provided 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 2001/5001/8001 angle encoders provide a safe absolute position value at all times—including immediately upon switch-on. Purely serial data are transmitted over the bidirectional EnDat 2.2 interface.

Along with the data interface, the mechanical connection of the encoder to the motor is also safety-relevant.

Table D8 of the EN 61800-5-2 standard for electrical motors defines the loosening of the mechanical connection between the encoder and motor as a fault requiring 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

There are various ways of connecting the RCN 2001, RCN 5001, and RCN 8001 series for providing 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 deviating 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 designing the mechanical fault exclusion for other purely customer-side connections, the following encoder torque must be taken into account:

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

J: Moment of inertia of the encoder (for rotor or stator, see 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)

α: Maximum angular acceleration in the application

$M_{Friction}$: RCN 2001: 4.5 Nm
RCN 5001: 4.5 Nm
RCN 8001 (Ø 60 mm): 7.5 Nm
RCN 8001 (Ø 100 mm): 8.5 Nm

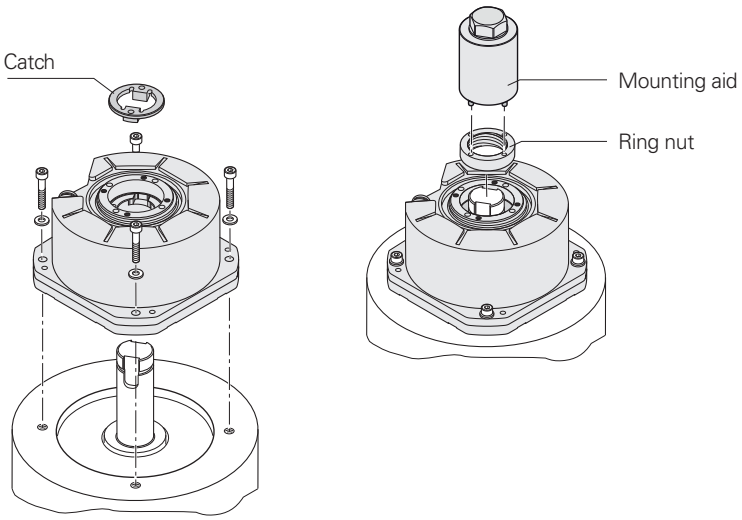
Mechanical connection	Fastening[1]	Safe position for the mechanical connection[2]	Limited specifications[3]
Housing/flange	*RCN 2001/5001:* Screws: M4 ISO 4762 8.8 *RCN 8001:* Screws: M5 ISO 4762 8.8	±0°	See permissible angular acceleration under *Mounting*
Hollow shaft Shaft coupling with ring nut	Ring nut and catch (see *Mounting*)	*RCN 2001:* ±0.55° *RCN 5001:* ±0.35° *RCN 8001:* Ø 60 mm: ±0.15° Ø 100 mm: ±0.10°	
Hollow shaft Front-face shaft coupling	*RCN 2001/5001:* Screws: M3 ISO 4762 8.8 Spring pins: ISO 8752 – 2.5x10 – St *RCN 8001:* Screws: M4 ISO 4762 8.8 Spring pins: ISO 8752 – 4x10 – St	*RCN 2001:* ±0.07° *RCN 5001:* ±0.06° *RCN 8001:* ±0.02°	

[1] A suitable anti-rotation lock must be used for the screw connections (mounting/servicing)
[2] Fault exclusions are given only for the explicitly mentioned mounting options
[3] Compared with standard encoders (see the *Angle Encoders with Integral Bearing* brochure)

Mounting with mechanical fault exclusion

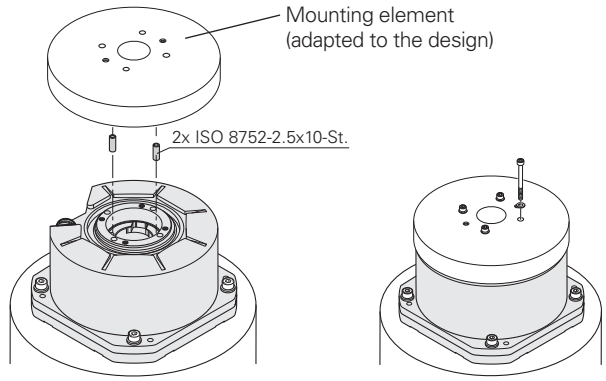
The housing of the RCN is firmly connected to the mounting surface of the machine component via a mounting flange and centering collar.

Shaft coupling with ring nut
During mounting, the hollow shaft of the angle encoder is seated onto the machine shaft. The **catch**, which is attached to the encoder's front face, implements the fault exclusion for the loosening of the mechanical connection between the encoder and the motor. Fastening is then performed with the ring nut, which can be easily tightened with the mounting aid (for accessories and their moment of inertia, see *Accessories* on pages 25 and 26).



Shaft coupling with ring nut and catch (RCN 2001 as example)

Front-face shaft coupling
Particularly in the case of rotary tables, the angle encoder must be integrated into the table so as to be fully accessible when the rotor is lifted. The hollow shaft is connected through the front-face threaded holes by means of special mounting elements made for the given design (not included in delivery). For compliance with the radial runout and axial runout tolerances, the inside hole and the 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 (RCN 2001 as example)

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

	Mating shaft	Mating stator
Material	Ferrous materials (steel/cast iron materials)	
Tensile strength R_m	≥ 600 N/mm²	≥ 250 N/mm²
Shear strength τ_B	≥ 390 N/mm²	≥ 290 N/mm²
Interface pressure p_G	≥ 660 N/mm²	≥ 275 N/mm²
Modulus of elasticity E	110 000 N/mm² to 215 000 N/mm²	
Coefficient of expansion α_{therm} (at 20 °C)	$10 \cdot 10^{-6}$ K^{-1} to $17 \cdot 10^{-6}$ K^{-1}	
Mounting temperature	All information regarding screw connections is based on a mounting temperature of 15 °C to 35 °C	

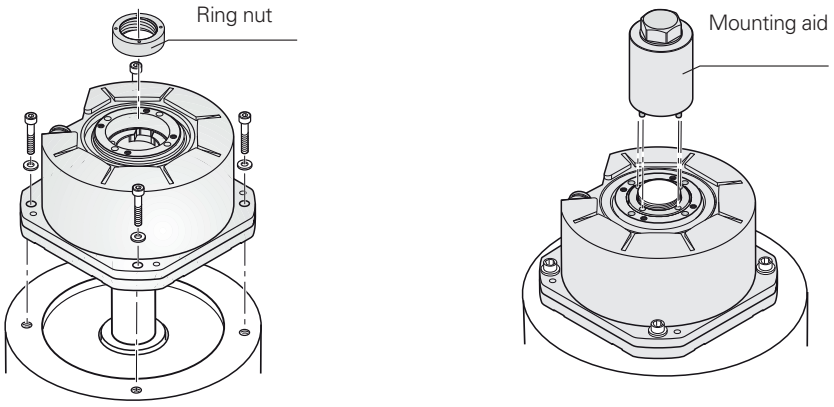
Permissible angular accelerations for shaft coupling with mechanical fault exclusion
Based on where acceleration is applied and the type of mounting, the following values apply to angular acceleration:

- Permissible angular acceleration of the rotor when acceleration is applied via the hollow shaft and shaft coupling with ring nut and catch:
  RCN 2001 series: 20 000 rad/s²
  RCN 5001 series: 25 000 rad/s²
  RCN 8001 series:
  – Ø 60 mm: 4500 rad/s²
  – Ø 100 mm: 3500 rad/s²
- Permissible angular acceleration of the rotor when acceleration is applied via the hollow shaft and front-face shaft coupling with fastening screws and spring pins:
  RCN 2001 series: 5500 rad/s²
  RCN 5001 series: 10 000 rad/s²
  RCN 8001 series:
  – Ø 60 mm: 3000 rad/s²
  – Ø 100 mm: 3000 rad/s²
- Permissible angular acceleration of the stator when acceleration is applied via the flange/housing:
  RCN 2001 series: 4000 rad/s²
  RCN 5001 series: 2500 rad/s²
  RCN 8001 series:
  – Ø 60 mm: 1000 rad/s²
  – Ø 100 mm: 1000 rad/s²

Mounting without mechanical fault exclusion

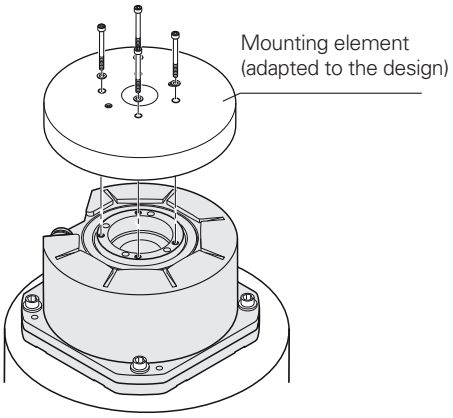
The housing of the RCN is firmly connected to the mounting surface of the machine component via a mounting flange and centering collar.

Shaft coupling with ring nut
For installation, the hollow through shaft of the angle encoder is seated onto the machine shaft and fastened from the encoder's front face with a ring nut. The ring nut can be easily tightened by means of the mounting tool (see *Accessories* on pages 25 and 26).



Shaft coupling with ring nut (RCN 2001 as example)

Front-face shaft coupling
The hollow shaft is connected through the front-face threaded holes by means of special mounting elements made for the given design (not included in delivery). For compliance with the radial runout and axial runout tolerances, the inside hole and the plane surfaces must be used as mounting surfaces for the front-face shaft coupling.



Front-face shaft coupling (RCN 2001 as example)

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

	Mating shaft	Mating stator
Material	Ferrous materials (steel/cast iron materials)	
Tensile strength R_m	≥ 600 N/mm^2	≥ 250 N/mm^2
Shear strength τ_B	≥ 390 N/mm^2	≥ 290 N/mm^2
Interface pressure p_G	≥ 660 N/mm^2	≥ 275 N/mm^2
Modulus of elasticity E	110 000 N/mm^2 to 215 000 N/mm^2	
Coefficient of thermal expansion α_{therm} (at 20 °C)	$10 \cdot 10^{-6}$ K^{-1} to $17 \cdot 10^{-6}$ K^{-1}	
Mounting temperature	All information regarding screw connections is based on a mounting temperature of 15 °C to 35 °C	

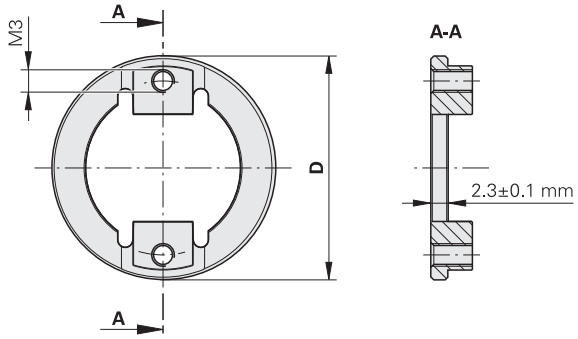
Permissible angular accelerations
The permissible angular acceleration of the rotor and stator is 1000 rad/s^2.

РЕМСТАНМАШ
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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 RCN 2001: ID 817921-01
Catch for RCN 5001: ID 817921-02
Catch for RCN 8001:
– Hollow shaft (Ø 60 mm): ID 817921-03
– Hollow shaft Ø 100 mm: ID 817921-04



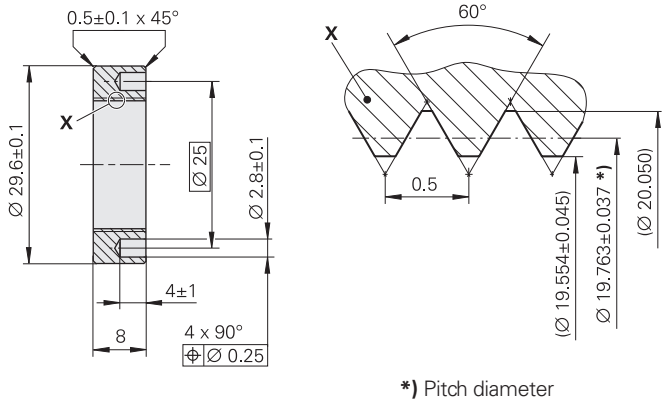
	D (mm)	Moment of inertia of ring nut and catch
RCN 2001	29.6	$4.8 \cdot 10^{-6}$ kgm^2
RCN 5001	45.8	$24 \cdot 10^{-6}$ kgm^2
RCN 8001 (Ø 60 mm)	70	$87 \cdot 10^{-6}$ kgm^2
RCN 8001 (Ø 100 mm)	114	$550 \cdot 10^{-6}$ kgm^2

Catch for the RCN 2001/RCN 5001/RCN 8001

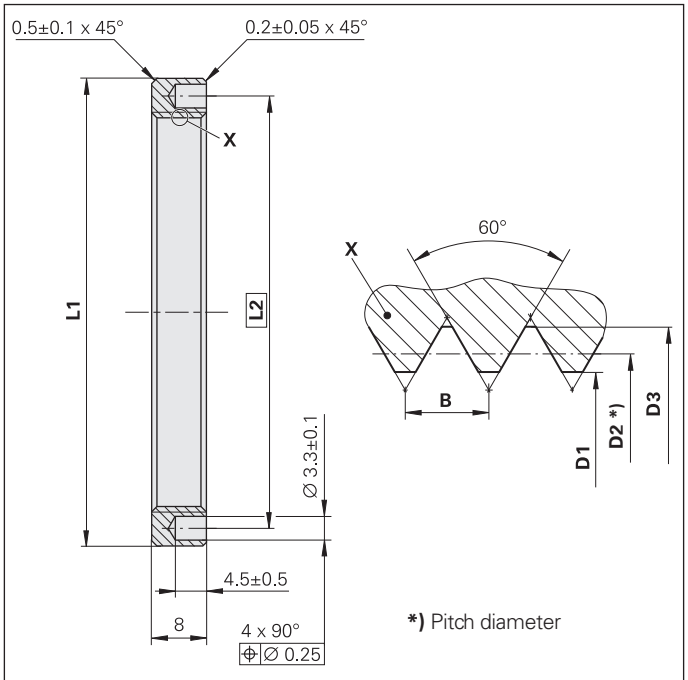
Ring nut
For fastening of the shaft, HEIDENHAIN offers a special ring nut that, with low axial play, smoothly rotates along with the shaft thread. This ensures that the load is evenly distributed over the shaft connection and prevents adverse loading on the angular encoder's hollow shaft.



Ring nut for the RCN 2001: ID 336669-03
Ring nut for the RCN 5001: ID 336669-17
Ring nut for the RCN 8001:
– Hollow shaft (Ø 60 mm): ID 336669-11
– Hollow shaft (Ø 100 mm): ID 336669-16



Ring nut for the RCN 2001



Ring nut for the RCN 5001/RCN 8001

Ring nut for	L1	L2	D1	D2	D3	B
RCN 5001	Ø 46±0.2	Ø 40	(Ø 34.052 ±0.075)	Ø 34.463 ±0.053	(Ø 35.24)	1
RCN 8001 hollow shaft (Ø 60)	Ø 70±0.2	Ø 65	(Ø 59.052 ±0.075)	Ø 59.469 ±0.059	(Ø 60.06)	1
RCN 8001 hollow shaft (Ø 100)	Ø 114±0.2	Ø 107	(Ø 98.538 ±0.095)	(Ø 99.163 ±0.07)	(Ø 100.067)	1.5

РЕМСТАНМАШ
ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

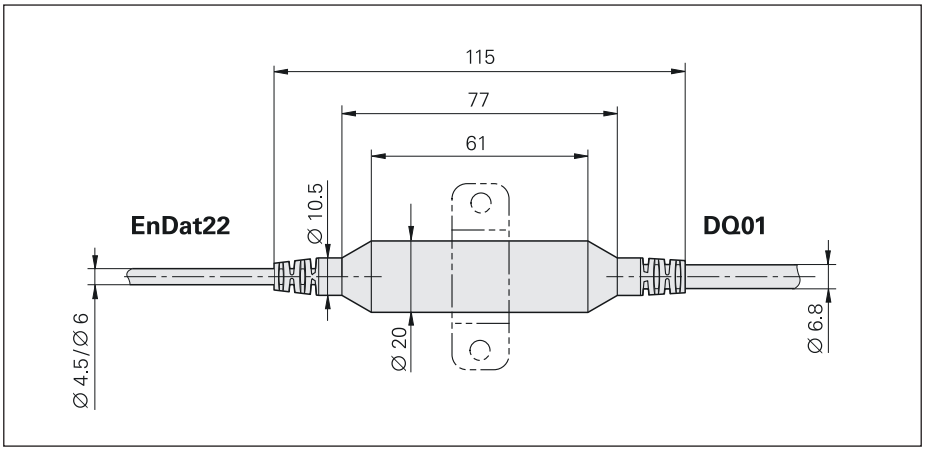
Mounting tool for HEIDENHAIN ring nut
The mounting tool is used for tightening the ring nut. The tool's pins lock into the holes in the ring nut. A torque wrench allows the ring nuts to be tightened with the required tightening torque.

Mounting tool for
RCN 2001: ID 530334-03
RCN 5001: ID 530334-17
RCN 8001:
– Hollow shaft Ø 60 mm: ID 530334-11
– Hollow shaft Ø 100 mm: ID 530334-16



EIB 3392S external interface box in cable design
The EIB 3392S allows encoders with the "EnDat22" ordering designation to be connected to the DRIVE-CLiQ interface.





DRIVE-CLiQ is a registered trademark of Siemens AG.

EIB 5211or EIB 5212 sensor box
The EIB 5211 sensor box from HEIDENHAIN, or the EIB 5212 with additional switching outputs, is installed in close proximity to the direct drive motor and permits the digitization of motor temperature data close to the application. In doing so, the EIB 5211or EIB 5212 processes up to three temperature sensors, determines the maximum temperature value, and forwards these data to an RCN xxx1.

Depending on the direct drive motor, a specially programmed variant of the the EIB 5211or EIB 5212 may be necessary:
- Configuration of the temperature sensors
- A particular compensation value for the transmission timing behavior of the temperature measurement

The following sensor types can be evaluated:
- KTY 84-130
- PT 1000
- PTC
- PTC triplet

The maximum value is transmitted over an adapter cable (ID 1249072-xx) to the angle encoder while compensating for the transmission timing characteristics. In addition to the position data, this value is then relayed to the control via the EnDat, Fanuc, or DRIVE-CLiQ purely digital interfaces (e.g., via the EIB 3392S external interface box in cable form). The sensor box does not influence the encoder interface; this means that the interface is determined by the connected encoder.



Further information:
For a more detailed description of the sensor boxes, refer to the EIB 5000 Product Information document.

Adapter cables and connecting cables

EnDat adapter cables and connecting cable without incremental signals

PUR adapter cables **Ø 4.5 mm;** 1 × (4 × 0.09 mm²) + 4 x 0.16 mm²; A_P = 2 x 0.16 mm²		
Adapter cable with 12-pin M12 quick connector and 8-pin M12 coupling (male)		729681-xx
Adapter cable with 12-pin M12 quick connector and 15-pin D-sub connector (female)		1119394-xx
PUR adapter cables and connecting cable Ø 6 mm; 2 × (2 × 0.09 mm²) + 2 × (2 × 0.16 mm²); A_P = 2 × 0.16 mm²		
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (female)		1036521-xx
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male)		1036526-xx
Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		1036372-xx

EnDat adapter cables and connecting cable with incremental signals

Adapter cables **Ø 6 mm;** 6 × (2 × 0.19 mm²); A_P = 2 × 0.19 mm²		
Adapter cable with 12-pin M12 quick connector and 17-pin M23 coupling (male)		643450-xx
Adapter cable with 12-pin M12 quick connector and 15-pin D-sub connector (female)		727658-xx
PUR adapter cables and connecting cable Ø 8 mm; 4 × (2 × 0.16 mm²) + (4 × 0.5 mm² + 4 × 0.16 mm²); A_P = 2 × 0.5 mm²		
Adapter cable with 17-pin M23 connector (female) and 15-pin D-sub connector (female)		332115-xx
Adapter cable with 17-pin M23 connector (female) and 15-pin D-sub connector (male)		324544-xx
Connecting cable with 17-pin M23 connector (female) and stripped cable end		309778-xx

РЕМСТАНМАШ
ТЕХНОЛОГИИ ДЛЯ ПРОИЗВОДСТВА

Fanuc/Mitsubishi adapter cables and connecting cable

PUR adapter cables **Ø 4.5 mm;** (4 × 0.09 mm²) + (4 × 0.16 mm²); A_P = 2 × 0.16 mm²		**Fanuc**	**Mitsubishi**
Adapter cable with 12-pin M12 quick connector and 15-pin Mini Delta Ribbon connector (female) or 10-pin Mini Delta Ribbon connector (female)		1119918-xx	1119925-xx
Adapter cable with 12-pin M12 quick connector and 20-pin Mini Delta Ribbon connector (male)		–	1119920-xx
Adapter cable with 12-pin M12 quick connector and 8-pin M12 coupling (male)		729681-xx	

PUR connecting cable **Ø 6 mm;** 2 × (2 × 0.09 mm²) + 2 × (2 × 0.16 mm²); A_P = 2 × 0.16 mm²		**Fanuc**	**Mitsubishi**
Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		1036372-xx	

Adapter cable between the RCN 2001/RCN 5001/RCN 8001 and the EIB 5211 or EIB 5212

PUR adapter cable **Ø 6 mm;** 4 × (2 × 0.09 mm²) + (4 × 0.16 mm²); A_P = 2 × 0.16 mm²		
Adapter cable with 12-pin M12 quick connector and 12-pin M12 coupling (male)		1249072-xx[1)]

[1)] Max. cable length: 6 m
A_P: Cross section of power supply lines
Ø: 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 other cables, see the *Cables and Connectors* brochure**.**

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH
Dr.-Johannes-Heidenhain-Straße 5
83301 Traunreut, Germany
☎ +49 8669 31-0
FAX +49 8669 32-5061
E-mail: info@heidenhain.de

www.heidenhain.de

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.

Further information:

To ensure proper and intended use, comply with the specifications in the following documents:

- Brochure: *Angle Encoders with Integral Bearing* 591109-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Mounting Instructions, e.g.,: *RCN 2001 FS* 1307425-xx
  RCN 5001 FS 1307427-xx
  RCN 8001 FS Ø *60 mm* 1307429-xx
  Ø *100 mm* 1307431-xx
- Brochure: *Cables and Connectors* 1206103-xx
- Product Information document: *EIB 5000* 1309514-xx
- Technical Information document:
  Safety-Related Position Measuring Systems 596632-xx
- Specification for safe control 533095-xx

For brochures and Product Information documents, visit **www.heidenhain.de.**