HEIDENHAIN

Product Information

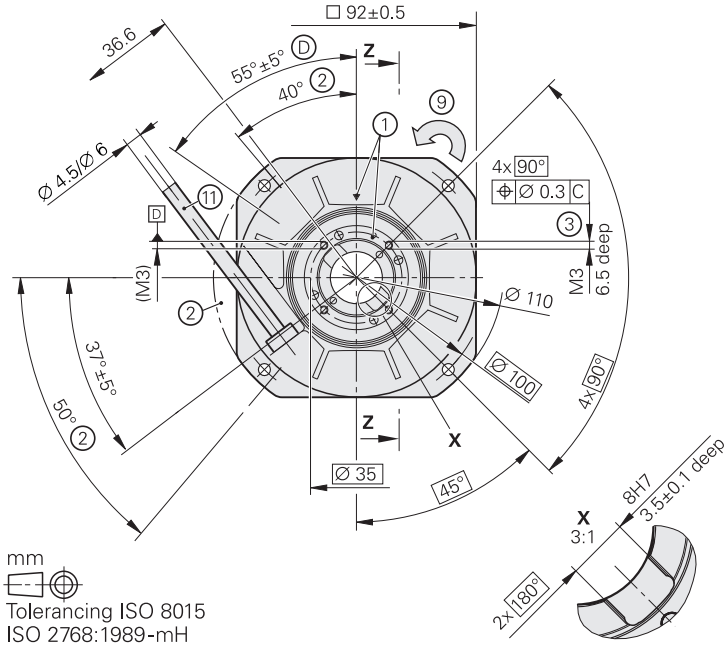
RCN 2001

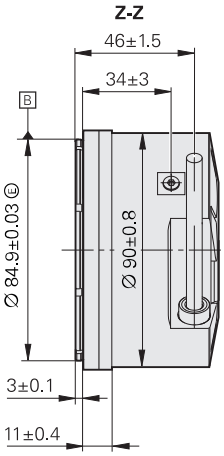
Absolute Angle Encoders
with Fixed Cable Outlet

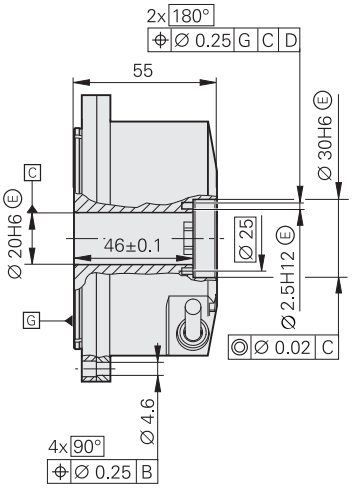
02/2023

RCN 2001 series with fixed cable outlet

The latest generation of absolute angle encoders
- **System accuracies: ±2″ and ±4″**
- **Integrated temperature sensor**
- **Suitability for high shaft speeds**
- **Hollow through shaft (Ø 20 mm)**





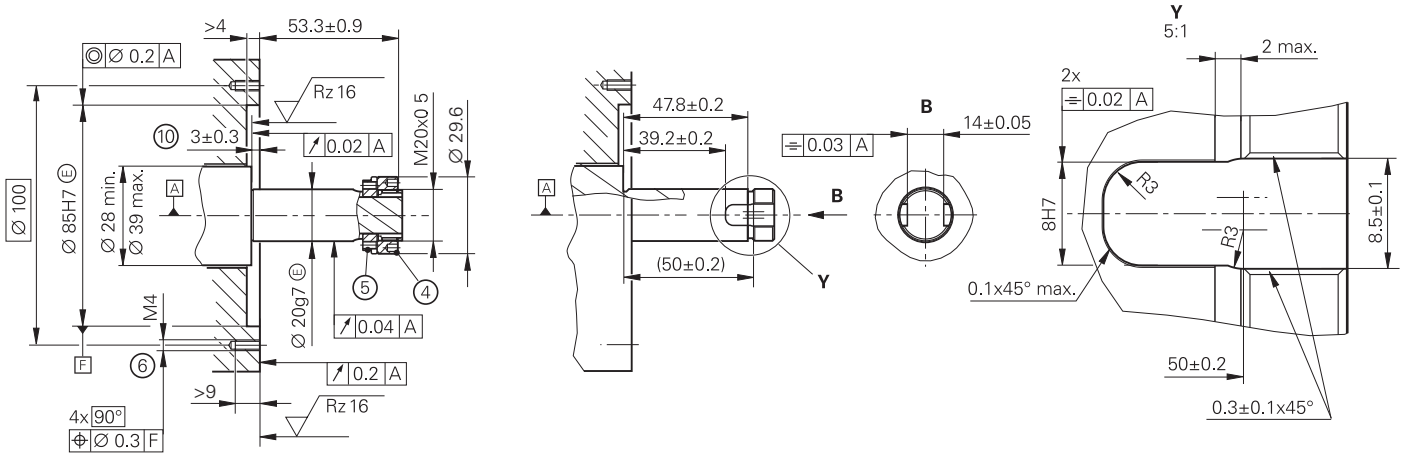


mm

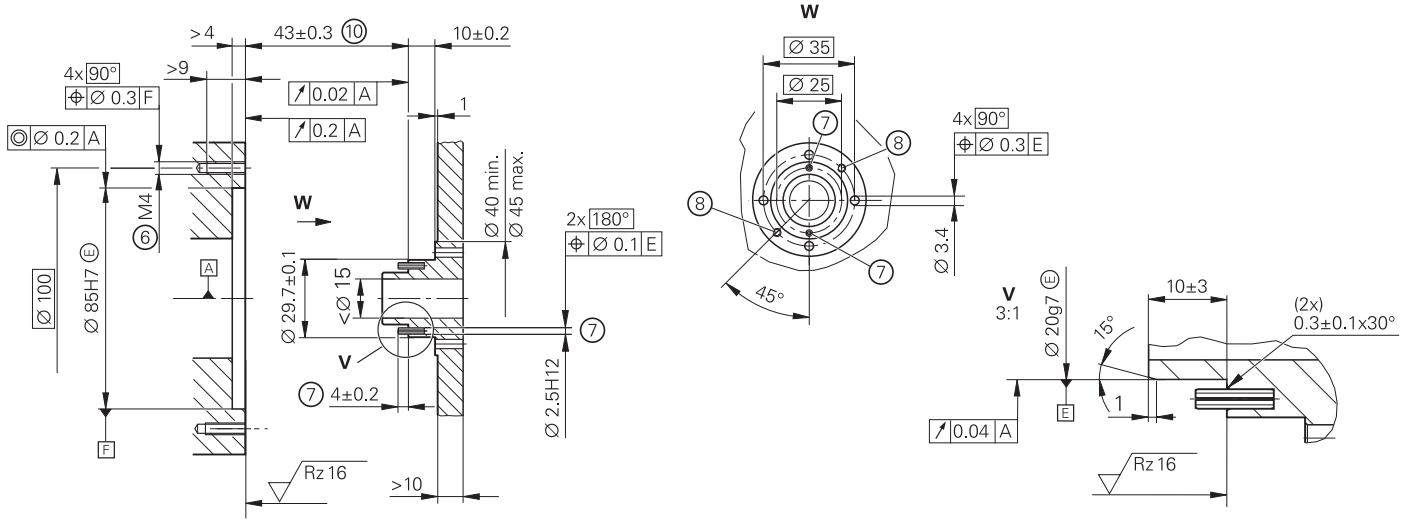
Tolerancing ISO 8015
ISO 2768:1989-mH
≤ 6 mm: ±0.2 mm

Ⓐ = Bearing of mating shaft
Ⓓ = Compressed air inlet
Ⓚ = Required mating dimensions
1 = Mark for 0° position ±5°
2 = Free space for customer
3 = Thread engagement: 4.5 mm ±0.5 mm (for M3 cylinder head screws; for details, see the mounting instructions)
4 = Accessory: ring nut (ID 336669-03)
5 = Accessory: catch (ID 817921-01)
6 = Thread engagement: 8 mm ±1 mm (for M4x20 cylinder head screws; for details, see the mounting instructions)
7 = Two spring pins: ISO 8752 – 2.5x10 – St
8 = If spring pins are used, then provide additional M3 back-off threads
9 = Direction of shaft rotation for ascending position values
10 = Stated tolerance includes mounting tolerances and thermal expansion; no dynamic movement permitted
11 = Bend radius under repeated loading and with:
– 6 mm diameter cable: R ≥ 75 mm
– 4.5 mm diameter cable: R ≥ 50 mm
Bend radius under one-time bending and with:
– 6 mm diameter cable: R ≥ 20 mm
– 4.5 mm diameter cable: R ≥ 10 mm

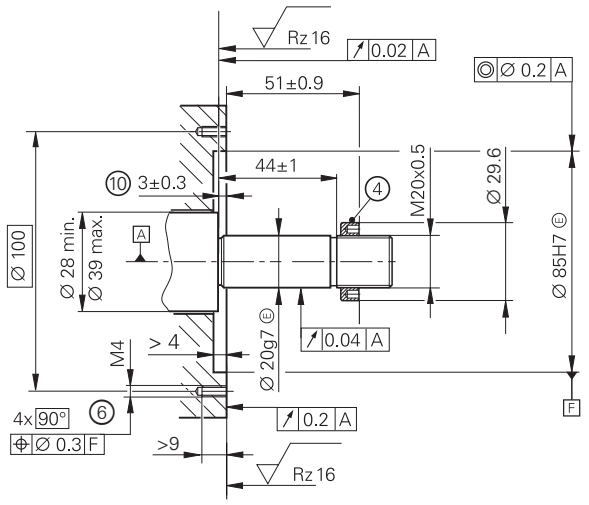
Shaft coupling with ring nut and catch (with mechanical fault exclusion) Ⓚ



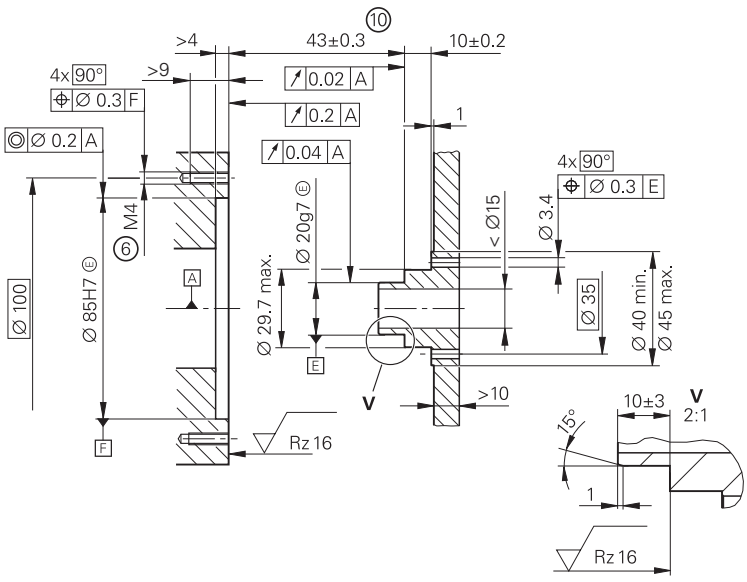
Front-face shaft coupling (with mechanical fault exclusion) Ⓚ



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



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



Specifications	*Absolute* RCN 2511 RCN 2311	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 25x1:* ≤ ±0.3″ *RCN 23x1:* ≤ ±0.4″	≤ ±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	EnDat22	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	≤ 3000 rpm for continuous position values	≤ 1500 rpm for continuous position values	≤ 3000 rpm for continuous position values	
Clock frequency Calculation time t_{cal}	≤ 16 MHz ≤ 5 µs	≤ 2 MHz ≤ 8 µs	–	
Incremental signals Cutoff frequency –3 dB	–	⌒ 1 V_{PP} ≥ 400 kHz	–	
Electrical connection	Cable (1 m) with 8-pin M12 coupling (male); with EnDat02: cable (1 m) with 17-pin M23 coupling (male)			
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 2x11/RCN 2x91:* ≤ 3000 rpm (at an operating temperature of 40 °C; for more details, see the *Angle Encoders with Integral Bearing* brochure) *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 coaxiliaty: 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 **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)

Fault exclusion for the loosening of the mechanical connection

For the RCN 2001 series, 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 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
$M_{Friction}$: 4.5 Nm

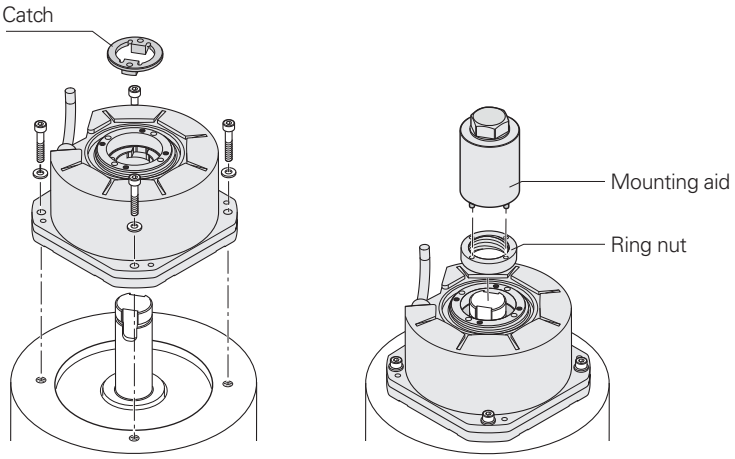
Mechanical connection	**Fastening**[1]	**Safe position for mechanical coupling**[2]	**Confined parameters**[3]
Housing/flange	Screws: M4 ISO 4762 8.8	±0°	See permissible angular acceleration under *Mounting*
Hollow shaft Shaft coupling with ring nut	Ring nut and catch (see *Mounting*)	±0.55°	
Hollow shaft Front-face shaft coupling	Screws: M3 ISO 4762 8.8 Spring pins: ISO 8752 – 2.5x10 – St	±0.07°	

[1] A suitable anti-rotation lock must be used for the screw connections (mounting/servicing)
[2] Fault exclusion is granted only for the explicitly mentioned mounting options
[3] Unlike mounting without mechanical fault exclusion for the loosening of the mechanical connection

Mounting with mechanical fault exclusion

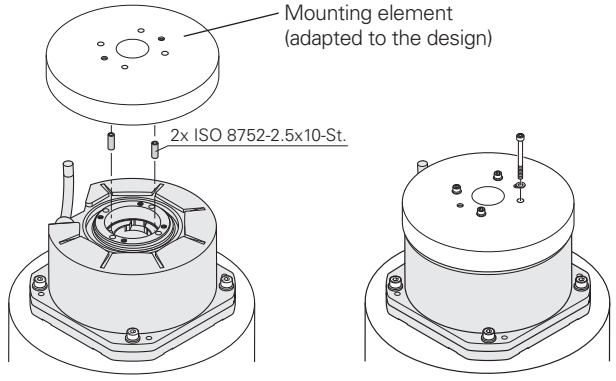
The housing of the RCN is firmly connected to the mounting surface of the machine component via a mounting flange and a centering collar.

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 moments of inertia, see *Accessories*).



Shaft coupling with ring nut and catch

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

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, the following values apply to angular acceleration:

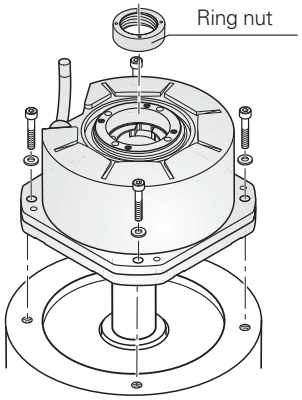
- Permissible angular acceleration when acceleration is applied through the hollow shaft and shaft coupling with ring nut and catch: 20000 rad/s^2
- Permissible angular acceleration of the rotor when acceleration is applied through the hollow shaft and front-face shaft coupling with fastening screws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

	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
Elastic modulus E	110000 N/mm^2 to 215000 N/mm^2	
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	

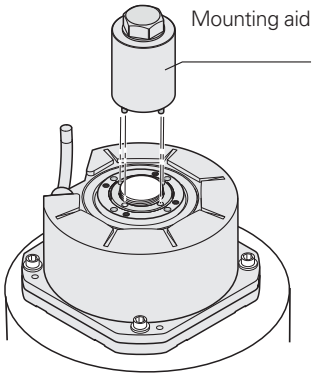
Mounting without mechanical fault exclusion

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

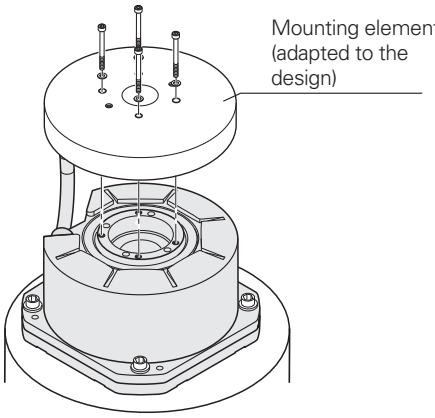
Shaft coupling with ring nut
For installation, the hollow through shaft of the angle encoder is seated onto the machine shaft and fastened from the encoder's front face with a ring nut. The ring nut can be easily tightened by means of the mounting tool (see *Accessories*).



Shaft coupling with ring nut



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 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.

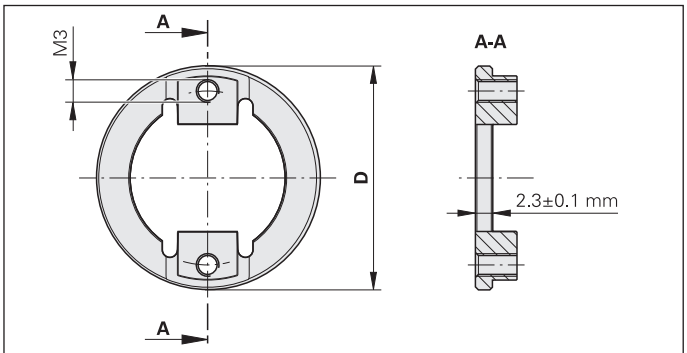
Permissible angular accelerations
The permissible angular acceleration of the rotor and stator is 1000 rad/s^2.

	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
Elastic modulus E	110000 N/mm^2 to 215000 N/mm^2	
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	

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.

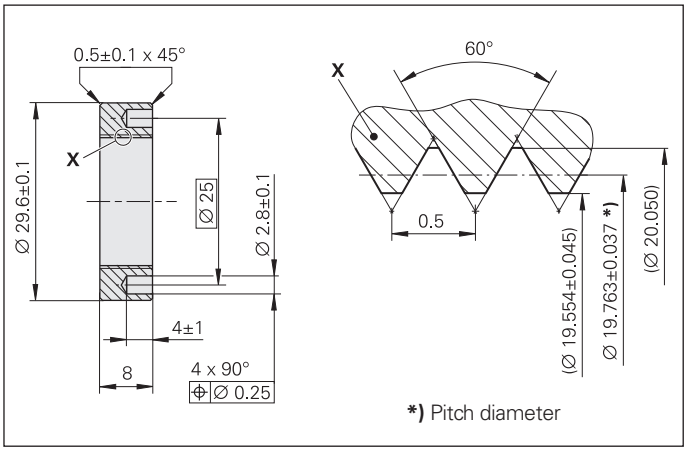
Catch for the RCN 2001: ID 817921-01



	D (mm)	Moment of inertia of ring nut and catch
RCN 2001	29.6	$4.8 \cdot 10^{-6}$ kgm^2

Ring nut
For fastening on the shaft side, HEIDENHAIN offers a special ring nut that is gently screwed onto the shaft thread with a small amount of axial play. 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



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

Mounting tool for the RCN 2001: ID 530334-03

Adapter cables and connecting cables

EnDat without incremental signals

PUR **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 with incremental signals

PUR **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

Fanuc/Mitsubishi

PUR **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	

A_P: Cross section of power supply lines
Ø: Cable diameter (for bend radii, see the *Interfaces of HEIDENHAIN Encoders* brochure)

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 placed.

More information:

Comply with the requirements described in the following documents to ensure correct and intended operation:

- Brochure: *Angle Encoders with Integral Bearing* 591109-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Brochure: *Cables and Connectors* 1206103-xx
- Mounting Instructions: *RCN 2001* 1339065-xx

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

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