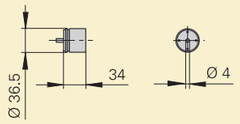
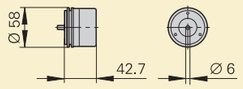
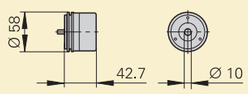
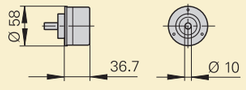
HEIDENHAIN

Rotary Encoders

12/2021

Rotary encoders for standard applications

Rotary encoders	**Absolute** **Singleturn**			**Multiturn** 4096 revolutions			**Incremental**			
Interface	EnDat	Fanuc Siemens	SSI	EnDat	Fanuc Siemens	SSI	⊓⊔ TTL	⊓⊔ HTL	∿ 1 V_{PP}	
For separate shaft coupling, with synchro flange										
ROC/ROQ/ROD 1000 series 	**ROC 1023** Positions/rev: 23 bits EnDat 2.2/22 **ROC 1013** Positions/rev: 13 bits EnDat 2.2/01	**ROC 1023 S** Positions/rev: 23 bits DRIVE-CLiQ	–	**ROQ 1035** Positions/rev: 23 bits EnDat 2.2/22 **ROQ 1025** Positions/rev: 13 bits EnDat 2.2/01	**ROQ 1035 S** Positions/rev: 23 bits DRIVE-CLiQ	–	**ROD 1020** 100 to 3600 lines **ROD 1070** 1000/2500/3600 lines[2]	**ROD 1030** 100 to 3600 lines	**ROD 1080** 100 to 3600 lines	 **52**
ROC/ROQ/ROD 400 series with synchro flange 	**ROC 425** Positions/rev: 25 bits EnDat 2.2/22 Available with functional safety **ROC 413** Positions/rev: 13 bits EnDat 2.2/01	**ROC 425 F** Positions/rev: 25 bits Fanuc αi **ROC 424 S** Positions/rev: 24 bits DRIVE-CLiQ Available with functional safety	**ROC 413** Positions/rev: 13 bits	**ROQ 437** Positions/rev: 25 bits EnDat 2.2/22 Available with functional safety **ROQ 425** Positions/rev: 13 bits EnDat 2.2/01	**ROQ 437 F** Positions/rev: 25 bits Fanuc αi **ROQ 436 S** Positions/rev: 24 bits DRIVE-CLiQ Available with functional safety	**ROQ 425** Positions/rev: 13 bits	**ROD 426** 50 to 5000 lines[1] **ROD 466**[3] 50 to 5000 lines[2]	**ROD 436** 50 to 5000 lines	**ROD 486**[5] 1000 to 5000 lines	 **56**
ROC 425 for high accuracy 	**ROC 425** Positions/rev: 25 bits EnDat 2.2/01	–	–	–	–	–	–	–	–	 **66**
For separate shaft coupling, with clamping flange										
ROC/ROQ/ROD 400 series with clamping flange 	**ROC 425** Positions/rev: 25 bits EnDat 2.2/22 Available with functional safety **ROC 413** Positions/rev: 13 bits EnDat 2.2/01	**ROC 425 F** Positions/rev: 25 bits Fanuc αi **ROC 424 S** Positions/rev: 24 bits DRIVE-CLiQ Available with functional safety	**ROC 413** Positions/rev: 13 bits	**ROQ 437** Positions/rev: 25 bits EnDat 2.2/22 Available with functional safety **ROQ 425**[4] Positions/rev: 13 bits EnDat 2.2/01	**ROQ 437 F** Positions/rev: 25 bits Fanuc αi **ROQ 436 S** Positions/rev: 24 bits DRIVE-CLiQ Available with functional safety	**ROQ 425** Positions/rev: 13 bits	**ROD 420** 50 to 5000 lines	**ROD 430** 50 to 5000 lines	**ROD 480**[5] 1000 to 5000 lines	 **68**

[1] Up to 10000 signal periods via integrated 2-fold interpolation
[2] Up to 36000 signal periods via integrated 5/10-fold interpolation (higher interpolation upon request)
[3] Supply voltage: DC 10 V to 30 V
[4] Also available with TTL or HTL signal transmission
[5] Available with mechanical fault exclusion; for deviating specifications and special mounting information, see the *Fault Exclusion* Customer Information document

Mechanical design types and mounting
Rotary encoders with stator coupling

The **ECN/EQN/ERN** rotary encoders feature integrated bearings and a mounted stator coupling. The stator coupling compensates for radial runout and alignment errors without significantly reducing the accuracy. The rotary encoder shaft is directly connected to the measured shaft. During angular acceleration of the shaft, the stator coupling must absorb only the torque resulting from friction within the bearing. The stator coupling permits a certain amount of axial motion in the measured shaft:

ECN/EQN/ERN 400:	±1 mm
ECN/EQN/ERN 1000:	±0.5 mm
ECN/ERN 100:	±1.5 mm

Mounting
The hollow shaft of the rotary encoder is slid onto the measured shaft and fastened on the rotor side by two screws or three eccentric clamps. Rotary encoders with a hollow through shaft can be clamped on the housing side as well. Particularly well suited for repeated mounting are the ECN/EQN/ERN 1300 series rotary encoders featuring a tapered shaft (see the *Encoders for Servo Drives* brochure). Stator-side mounting is performed on a plane surface without a centering collar. The **universal stator coupling** of the ECN/EQN/ERN 400 accommodates a variety of mounting scenarios; for example, it can be mounted to the motor housing from the outside via the provided threads.

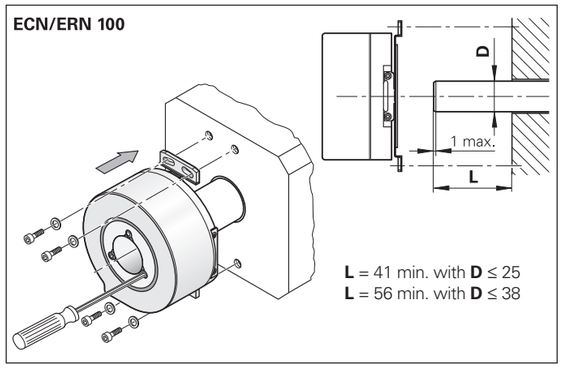
Mechanical fault exclusion is possible for the ECN/EQN/ERN 400 series rotary encoders featuring a standard stator coupling and blind hollow shaft.

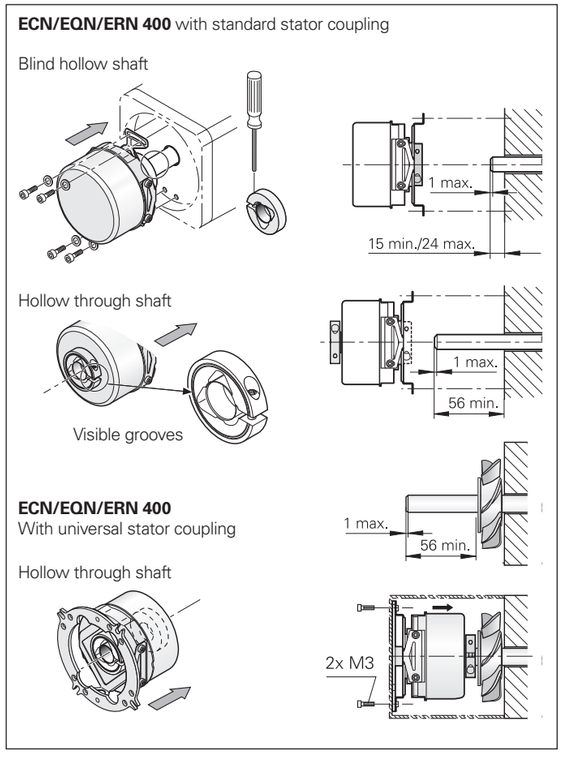
Dynamic applications require the highest possible natural frequencies fN of the system's coupling (see also General mechanical information).These natural frequencies can be attained through the shaft clamping on the flange side and a coupling with four screws. The ECN/EQN/ERN 1000 encoders offer an alternative with two screws and two washers.

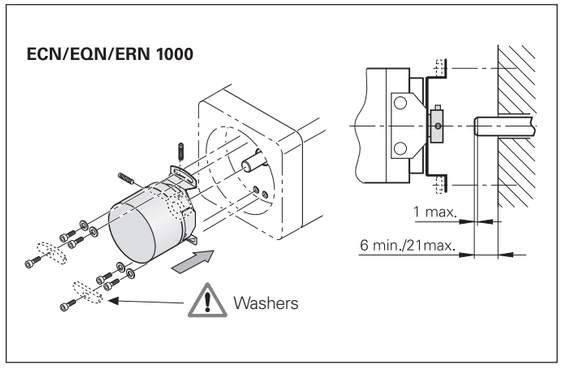
Typical natural frequency f_N of the connection with stator-side coupling via four screws:

	Stator coupling	Cable	Flange socket	
			Axial	Radial
ECN/EQN/ERN 400	Standard	1550 Hz	1500 Hz	1000 Hz
	Universal	1400 Hz[1)]	1400 Hz	900 Hz
ECN/ERN 100		1000 Hz	–	400 Hz
ECN/EQN/ERN 1000		1500 Hz[2)]	–	–

[1)] Also with fastening via two screws
[2)] Also with fastening via two screws and washers





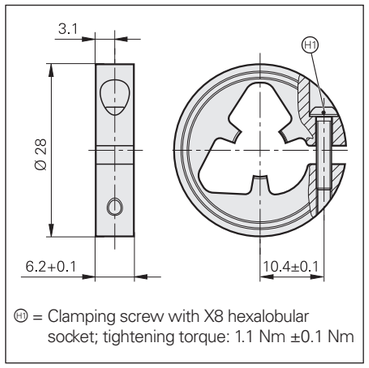


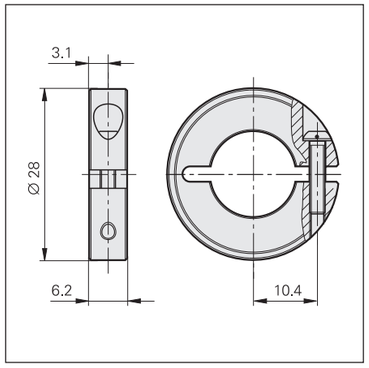
Mounting accessories

Clamping ring
For the ECN/EQN/ERN 400
Through the use of a second clamping ring, the maximum mechanically permissible shaft speed of rotary encoders with a hollow through shaft can be increased up to 12 000 rpm.
ID 540741-xx

In the case of safe, hollow-shaft connections, repeated fastening reduces the screw force. In order to maintain the required safety factor for friction-type connections, the maximum number of permissible screw tightening repetitions is limited to four. Beyond this number of repetitions, mechanical fault exclusion cannot be guaranteed. In such cases, new clamping rings must be ordered separately.

Clamping ring for 10 mm	ID 540741-06
Clamping ring for 12 mm	ID 540741-07



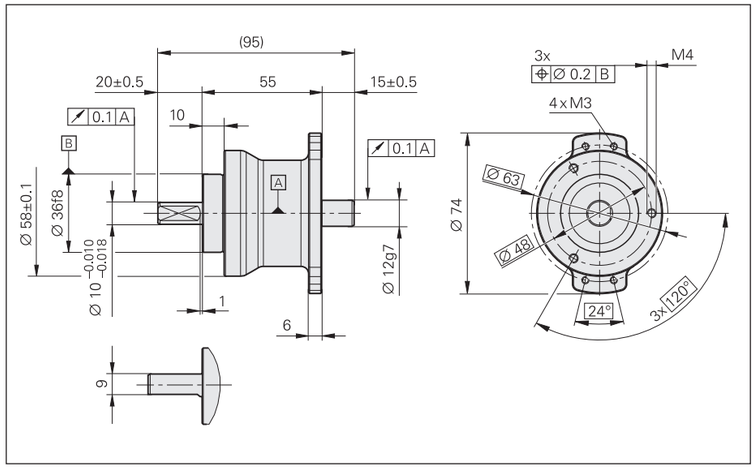


When **high shaft loads** are involved, such as with friction wheels, pulleys, or sprockets, HEIDENHAIN recommends mounting the ECN/EQN/ERN 400 with a bearing assembly.

Bearing assembly
For the ECN/EQN/ERN 400
with blind hollow shaft
ID 574185-03

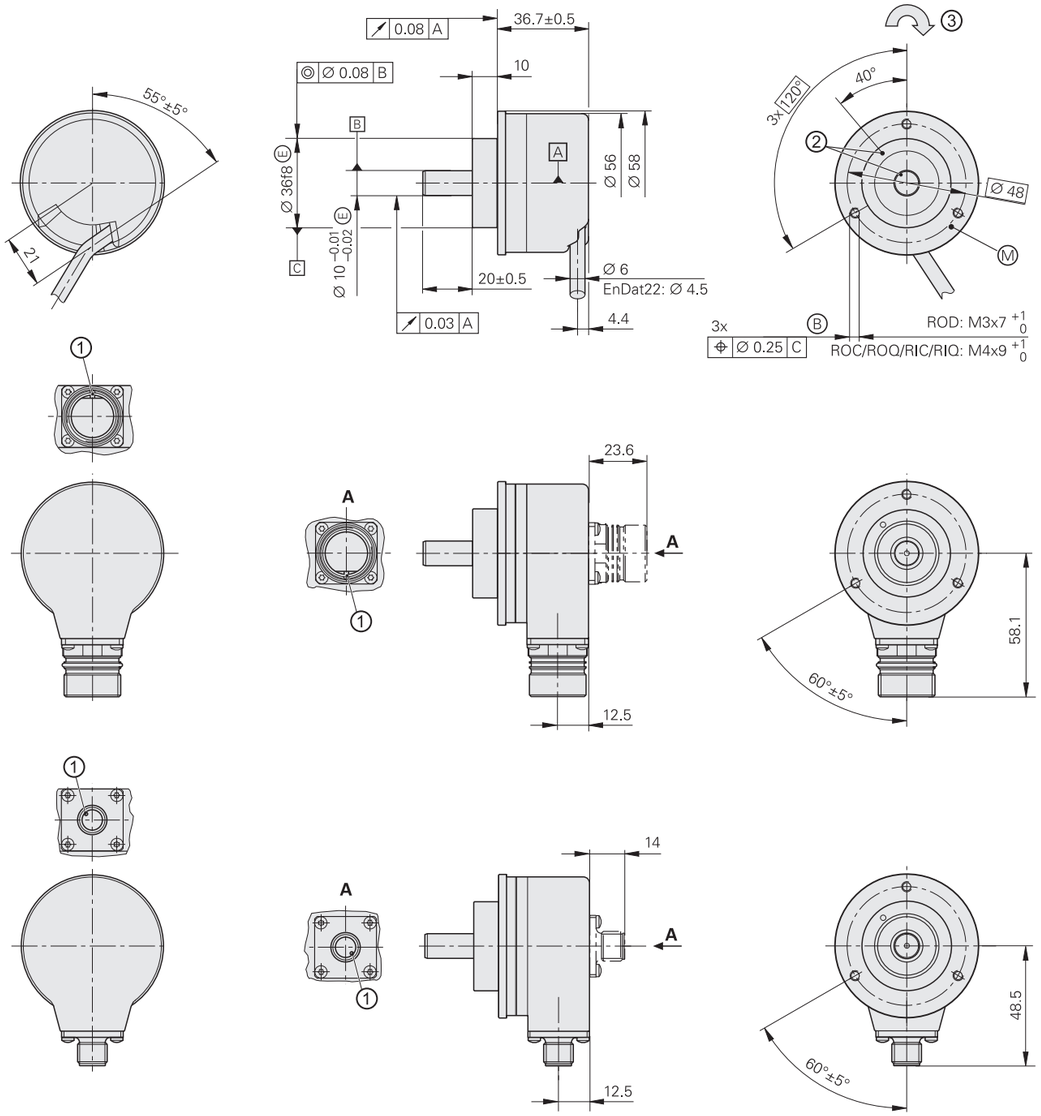
The bearing assembly is able to absorb large radial shaft loads and prevents overloading of the encoder bearing. On the encoder side, the bearing assembly features a shaft stub with a diameter of 12 mm, thus making it suitable for the ECN/EQN/ERN 400 encoders featuring a blind hollow shaft. The threaded holes for fastening the stator coupling are also already provided. The flange of the bearing assembly has the same dimensions as those of the clamping flange for the ROD 420/430 series. The bearing assembly can be fastened via the threaded holes on its front face or with the aid of the mounting flange or the mounting bracket (see page 21 for both).

	Bearing assembly
Permiss. shaft speed *n*	≤ 6000 rpm
Shaft load	Axial: 150 N; radial: 350 N
Operating temperature	–40 °C to 100 °C
Protection EN 60529	IP64



ROC/ROQ/ROD 400 series

Absolute and incremental rotary encoders
- **Clamping flange**
- **Solid shaft for separate shaft coupling**



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

Radial cable (can also be used axially)
Ⓐ = Bearing
Ⓑ = Fastening thread
Ⓜ = Measuring point for operating temperature
1 = Connector coding
2 = ROD reference mark position on shaft and flange ±15°
3 = Direction of shaft rotation for output signals as per the interface description

	Incremental		
	ROD 420	**ROD 430**	**ROD 480**
Interface	⊓⊔ TTL	⊓⊔ HTL	∿ 1 V_{PP} [1]
Line counts*	50 100 150 200 250 360 **500** 512 720		–
	1000 1024 1250 1500 1800 **2000 2048 2500 3600 4096 5000**		
Reference mark	One		
Cutoff frequency –3 dB Output frequency Edge separation *a*	– ≤ 300 kHz ≥ 0.39 µs		≥ 180 kHz – –
System accuracy	1/20 of grating period		
Electrical connection*	• **M23 flange socket**, radial and axial • **Cable (1 m/**5 m) with or **without M23 coupling**		
Supply voltage	DC 5 V ±0.5 V	DC 10 V to 30 V	DC 5 V ±0.5 V
Current consumption without load	≤ 120 mA	≤ 150 mA	≤ 120 mA
Shaft	Solid shaft Ø 10 mm		
Mech. permiss. shaft speed *n*	≤ 16000 rpm		
Starting torque (typical)	0.01 Nm (at 20 °C)		
Moment of inertia of rotor	≤ 2.1 · 10^{-6} kgm^2		
Shaft load [2]	*Axial:* ≤ 40 N; *radial:* ≤ 60 N at shaft end		
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 300 m/s^2 (EN 60068-2-6) ≤ 2000 m/s^2 (EN 60068-2-27)		
Max. operating temp. [3]	100 °C (80 °C for ROD 480 with 4096 or 5000 lines)		
Min. operating temp.	*Flange socket or fixed cable:* –40 °C *Moving cable:* –10 °C		
Protection EN 60529	IP67 at housing; IP64 at shaft inlet (IP66 upon request)		
Mass	≈ 0.3 kg		
Valid for ID	376840-xx	376834-xx	376880-xx [4]

Bold: This preferred version is available on short notice.
* Please select when ordering
1) Limited tolerances: signal amplitude: 0.8 V_{PP} to 1.2 V_{PP}
2) See also *Mechanical design types and mounting*
3) For the relationship of operating temperature to shaft speed and supply voltage, see *General mechanical information*
4) Available with mechanical fault exclusion; for deviating specifications and special mounting information, see the *Fault Exclusion* Customer Information document