



HEIDENHAIN



**Functional
Safety**

Product Information

ECN 425
EQN 437

Absolute Rotary Encoders
with EnDat22 for Safety-
Related Applications

ID 1327454-xx

ID 1327455-xx

06/2022

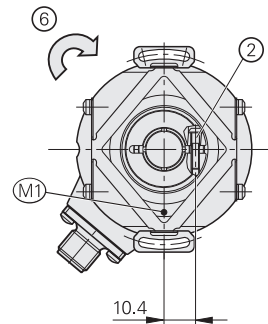
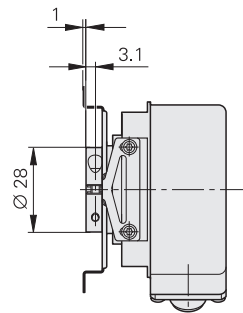
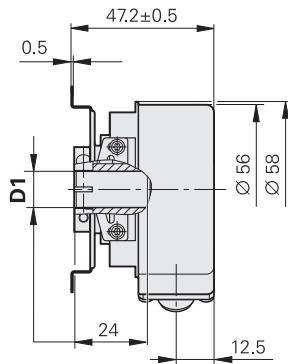
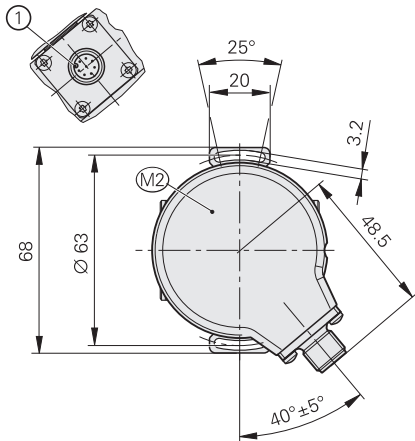
ECN 425, EQN 437

Rotary encoders for absolute position values with safe singleturn information

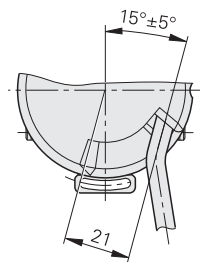
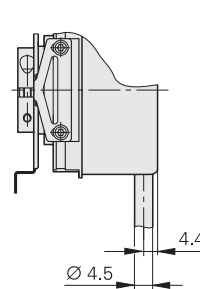
• Blind hollow shaft with steel clamping ring:

Ø 12 mm (68S)

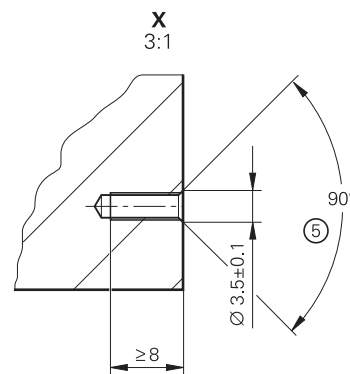
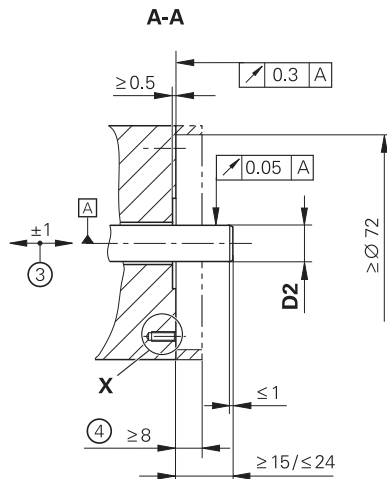
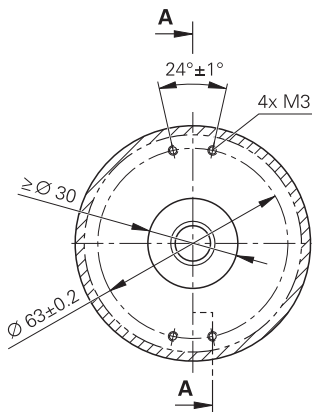
Ø 10 mm (68T)



D1	D2
Ø 10H6 \oplus	Ø 10g7 \ominus
Ø 12H6 \oplus	Ø 12g7 \ominus



Required mating dimensions



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

- ☐ = Bearing of mating shaft
- M1 = Measuring point for operating temperature
- M2 = Measuring point for vibration
- 1 = Connector coding
- 2 = X8 clamping screw with hexalobular socket; tightening torque: 1 Nm ±0.06 Nm
- 3 = Compensation of mounting tolerances and thermal expansion; no dynamic motion permitted
- 4 = Protection against contact as per EN 60529
- 5 = Chamfer at start of thread is obligatory for material bonding anti-rotation lock
- 6 = Direction of shaft rotation for ascending position values

Specifications	ECN 425	EQN 437
Functional safety for applications with up to	As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> • SIL 2 as per EN 61508 (further basis for testing: IEC 61800-5-3) • Category 3, PL d, according to EN ISO 13849-1:2015 Safe in the singleturn range	
PFH ¹⁾	$\leq 10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position ²⁾	Encoder: $\pm 1.76^\circ$ (safety-related measuring step: SM = 0.7°) Mechanical coupling: $\pm 2^\circ$ (fault exclusion for the loosening of the shaft and stator coupling; designed for accelerations $\leq 300 \text{ m/s}^2$; flange socket design: $\leq 150 \text{ m/s}^2$)	
Interface/ordering designation	EnDat 2.2/EnDat22	
Position values per revolution	33554432 (25 bits)	
Revolutions	–	4096 (12 bits)
Calculation time t_{cal} /clock frequency	$\leq 7 \mu\text{s}/\leq 16 \text{ MHz}$	
System accuracy at 20 °C	$\pm 20''$	
Supply voltage	DC 3.6 V to 14 V	
Power consumption ³⁾ (maximum)	At 3.6 V: $\leq 600 \text{ mW}$ At 14 V: $\leq 700 \text{ mW}$	At 3.6 V: $\leq 700 \text{ mW}$ At 14 V: $\leq 800 \text{ mW}$
Current consumption (typical)	At 5 V: 80 mA (without load)	At 5 V: 95 mA (without load)
Electrical connection *	8-pin M12 radial flange socket or PUR cable (1 m) with 8-pin M12 coupling (male)	
Cable length ⁴⁾	$\leq 100 \text{ m}$ (at clock frequency $\leq 8 \text{ MHz}$) $\leq 20 \text{ m}$ (at clock frequency $\leq 16 \text{ MHz}$)	
Shaft*	Blind hollow shaft D = 12 mm or D = 10 mm	
Permissible shaft speed	$\leq 6000 \text{ rpm}$	
Starting torque at 20 °C	$\leq 0.01 \text{ Nm}$	
Moment of inertia of rotor	$\leq 6 \cdot 10^{-6} \text{ kgm}^2$	
Angular acceleration of rotor	$\leq 4 \cdot 10^4 \text{ rad/s}^2$	
Permiss. axial motion of measured shaft	$\leq \pm 1 \text{ mm}$	
Vibration 55 Hz to 2000 Hz ⁵⁾ Shock 6 ms	$\leq 300 \text{ m/s}^2$; flange socket version: 150 m/s^2 (EN 60068-2-6) $\leq 2000 \text{ m/s}^2$ (EN 60068-2-27)	
Operating temperature ⁶⁾	–30 °C to 100 °C	
Trigger threshold for exceeded temperature error message ⁷⁾	125 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: $\pm 1 \text{ K}$)	
Relative humidity	$\leq 93\%$ (40 °C/21 d as per EN 60068-2-78), condensation excluded	
Protection rating EN 60529	IP67 on housing; IP64 at shaft inlet (read about insulation under <i>Electrical safety</i> in the <i>Interfaces of HEIDENHAIN Encoders</i> brochure; contamination from the ingress of fluids must be avoided)	
Mass	$\approx 0.3 \text{ kg}$	
ID number	1327454-03/1327454-05/1327454-06/ 1327454-04 (rapid delivery as preferred version)	1327455-03/1327455-05/1327455-06/ 1327455-04 (rapid delivery as preferred version)

* Please select when ordering

¹⁾ For use at $\leq 2000 \text{ m}$ above sea level

($\leq 6000 \text{ m}$ above sea level upon request)

²⁾ Further tolerances may arise in the downstream electronics after position value comparison (contact manufacturer)

³⁾ See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

⁴⁾ See the EnDat description in the *Interfaces of HEIDENHAIN Encoders* brochure

⁵⁾ 10 Hz to 55 Hz constant over 4.9 mm peak to peak (flange socket design: 2.45 mm peak to peak)

⁶⁾ For information on operating temperature, shaft speed, and supply voltage, see *General mechanical information* in the *Rotary Encoders* brochure

⁷⁾ The internal temperature evaluation is not designed with functional safety

Mounting

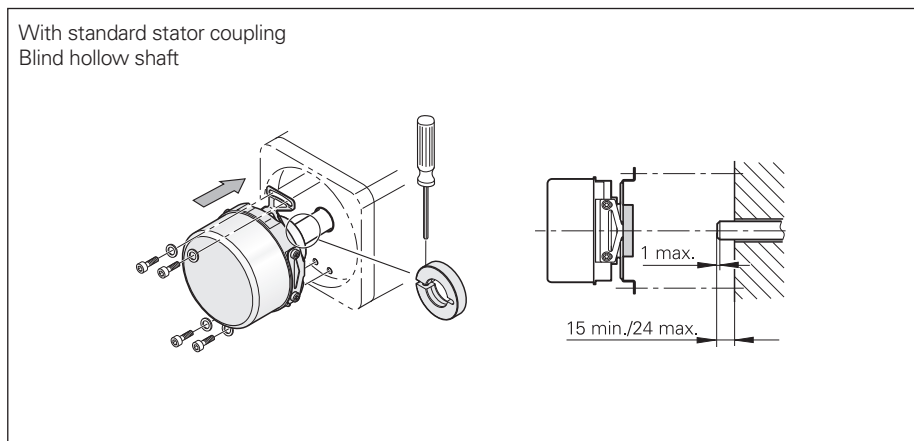
Mounting

The rotary encoder's hollow shaft is pressed onto its rotor side and clamped on its rotor side via a screw (tightening torque: $1 \text{ Nm} \pm 0.06 \text{ Nm}$). The stator is connected without a centering collar on a flat surface.

For the hollow-shaft connections 68S and 68T, repeated fastening reduces the screw retaining force. In order to maintain the required safety factor for friction-locked connections, the maximum permissible number of fastening procedures is limited to four. Beyond this number of repetitions, mechanical fault exclusion cannot be guaranteed. In such cases, new clamping rings must be separately ordered:

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

Cables with a length of more than 0.5 m must be provided with strain relief.



More information:


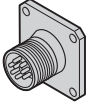
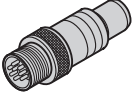
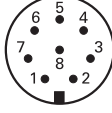


For the customer-side mounting design, the material specifications for steel apply to the customer-side shaft, and for the customer-side stator, the material specifications for aluminum apply.

Note the other material properties in the *Rotary Encoders* brochure.

For mounting tips and mounting aids, see the *Mounting Instructions* and the *Rotary Encoders* brochure.

Electrical connection

Pin layout

8-pin M12 flange socket or 8-pin M12 coupling								
								
	Power supply				Serial data transmission			
	8	2	5	1	3	4	7	6
	U_P	Sensor U_P	0V	Sensor 0V	DATA	DATA	CLOCK	CLOCK
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

Cable shield connected to housing; **U_P** = Power supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power supply line.

Vacant pins or wires must not be used!

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!

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:

- Operating Instructions

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