HEIDENHAIN

Functional Safety
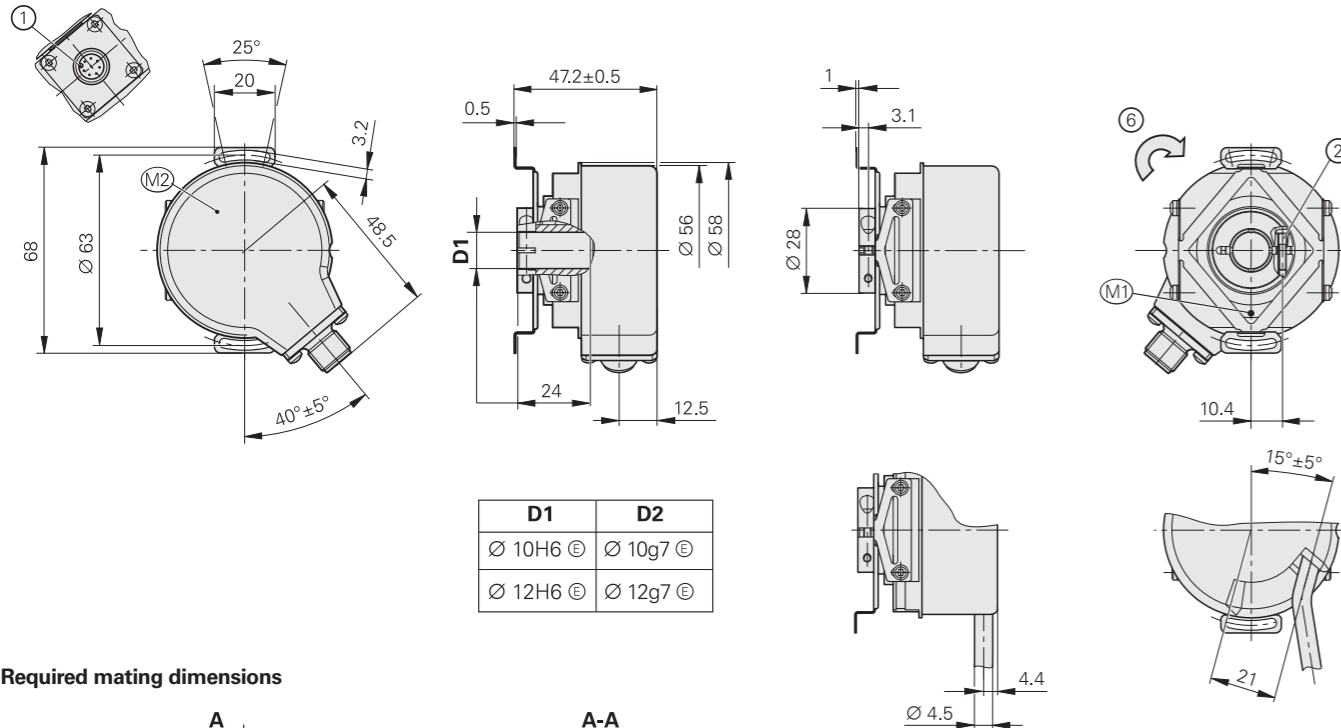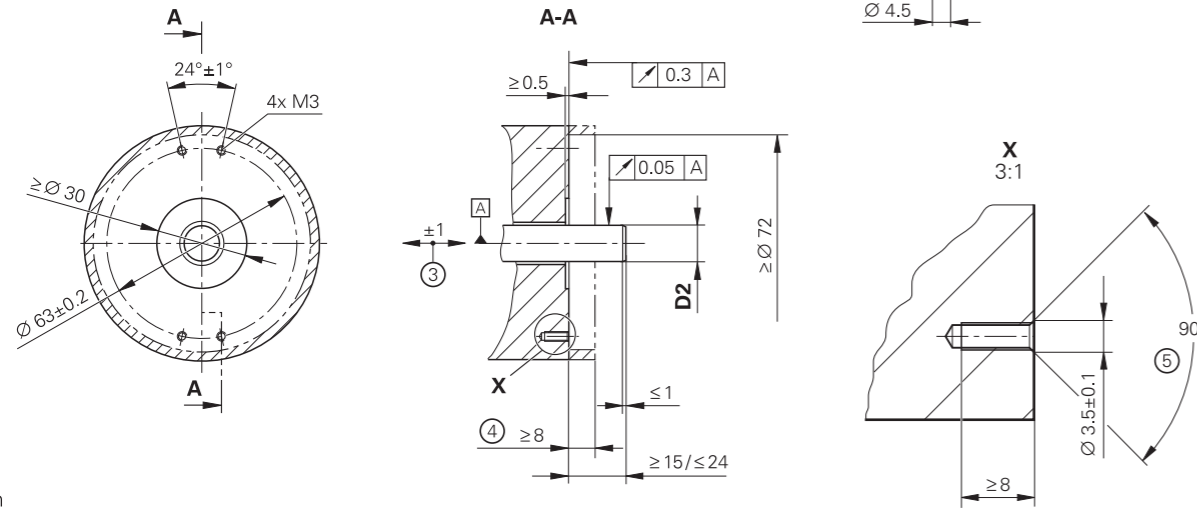
ECN 425, EQN 437

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)

Functional Safety

D1	D2
Ø 10H6 Ⓔ	Ø 10g7 Ⓔ
Ø 12H6 Ⓔ	Ø 12g7 Ⓔ

Required mating dimensions

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 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 materially 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 and control-loop functions:* • 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 Safe in the singleturn range	
PFH[1]	$\leq 10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[2]	*Encoder:* ±1.76° (safety-related measuring step: SM = 0.7°) *Mechanical coupling:* ±2° (fault exclusion for the loosening of the shaft and stator coupling, designed for accelerations ≤ 300 m/s^2; flange socket design: ≤ 150 m/s^2)	
Interface/ordering designation	EnDat 2.2 / EnDat22	
Position values per revolution	33 554 432 (25 bits)	
Revolutions	–	4096 (12 bits)
Calculation time t_{cal} / Clock frequency	≤ 7 µs / ≤ 16 MHz	
System accuracy at 20 °C	±20″	
Supply voltage	DC 3.6 V to 14 V	
Power consumption[3] (maximum)	*At 3.6 V:* ≤ 600 mW *At 14 V:* ≤ 700 mW	*At 3.6 V:* ≤ 700 mW *At 14 V:* ≤ 800 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 1 m cable with 8-pin M12 coupling (male)	
Cable length[4]	≤ 100 m (at clock frequency ≤ 8 MHz) ≤ 20 m (at clock frequency ≤ 16 MHz)	
Shaft*	Blind hollow shaft D = 12 mm or D = 10 mm	
Permissible shaft speed	≤ 6000 rpm	
Starting torque at 20 °C	≤ 0.01 Nm	
Moment of inertia of rotor	$\leq 6 \cdot 10^{-6}$ kgm^2	
Angular acceleration of rotor	$\leq 4 \cdot 10^{4}$ rad/s^2	
Permiss. axial motion of measured shaft	$\leq \pm 1$ mm	
Vibration 55 Hz to 2000 Hz[5] **Shock** 6 ms	≤ 300 m/s^2; flange socket version: 150 m/s^2 (EN 60068-2-6) ≤ 2000 m/s^2 (EN 60068-2-27)	
Operating temperature[6]	–30 °C to 100 °C	
Trigger threshold for error message due to temperature exceedance[7]	125 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: ±1 K)	
Relative humidity	≤ 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 *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochure; contamination from the ingress of fluids must be avoided)	
Mass	≈ 0.3 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 ≤ 2000 m above sea level (≤ 6000 m above sea level upon request)
[2] Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[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 the measured shaft and clamped on its rotor side via a screw (tightening torque: 1 Nm ±0.06 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 repetitions 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

With standard stator coupling
Blind hollow shaft

1 max.

15 min./24 max.
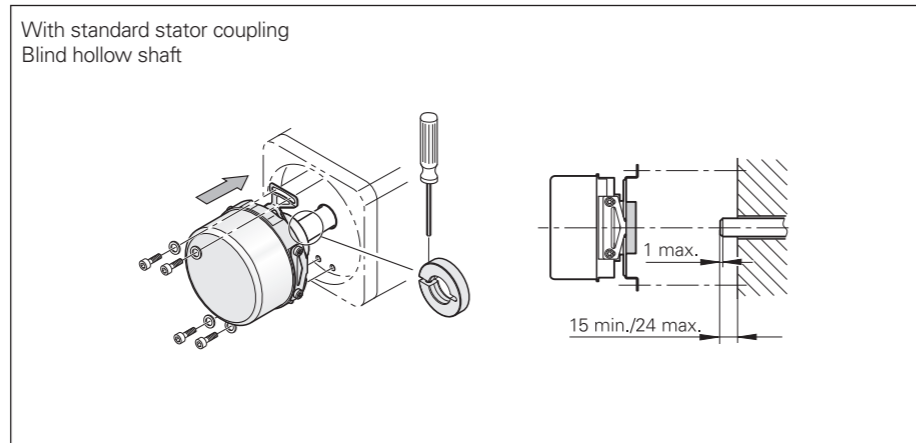
Rotary encoders may exert a torque of up to 1 Nm on the mating shaft. The customer-side mechanical design must be made for this load. Cables greater than 0.5 m in length must be provided with strain relief.

Further 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 flange socket or M12 coupling

	Power supply				Serial data transmission			
▭	**8**	**2**	**5**	**1**	**3**	**4**	**7**	**6**
	U_P	Sensor U_P	**0 V**	Sensor **0 V**	**DATA**	$\overline{\text{DATA}}$	**CLOCK**	$\overline{\text{CLOCK}}$
⌇	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.

Cables with M12 connecting elements

PUR connecting cables and adapter cables $\varnothing$ 6 mm; [(2 x 2 x 0.09 mm^2) + (2 x 2 x 0.16 mm^2)]; A_P = 2 x 0.16 mm^2		
Connecting cable with 8-pin M12 connector (female) and stripped cable end		1129581-xx[1]
Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		1036372-xx
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

A_P = Cross section of the supply wires
[1] Note the EMC requirements in the *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure.
Note for safety-related applications: Document the bit error rate in accordance with Specification 533095!

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.

Further information:

Comply with the requirements described in the following documents to ensure correct operation of the encoder:
• Brochure: *Rotary Encoders*   349529-xx
• Brochure: *Interfaces of HEIDENHAIN Encoders*   1078628-xx
• Brochure: *Cables and Connectors*   1206103-xx
• Mounting Instructions: *ECN 425/EQN 437*   1345173-xx
• Technical Information: *Safety-Related Position Measuring Systems*   596632-xx
• Specification for implementation in a safe control or inverter   533095-xx