HEIDENHAIN

Functional Safety

Product Information

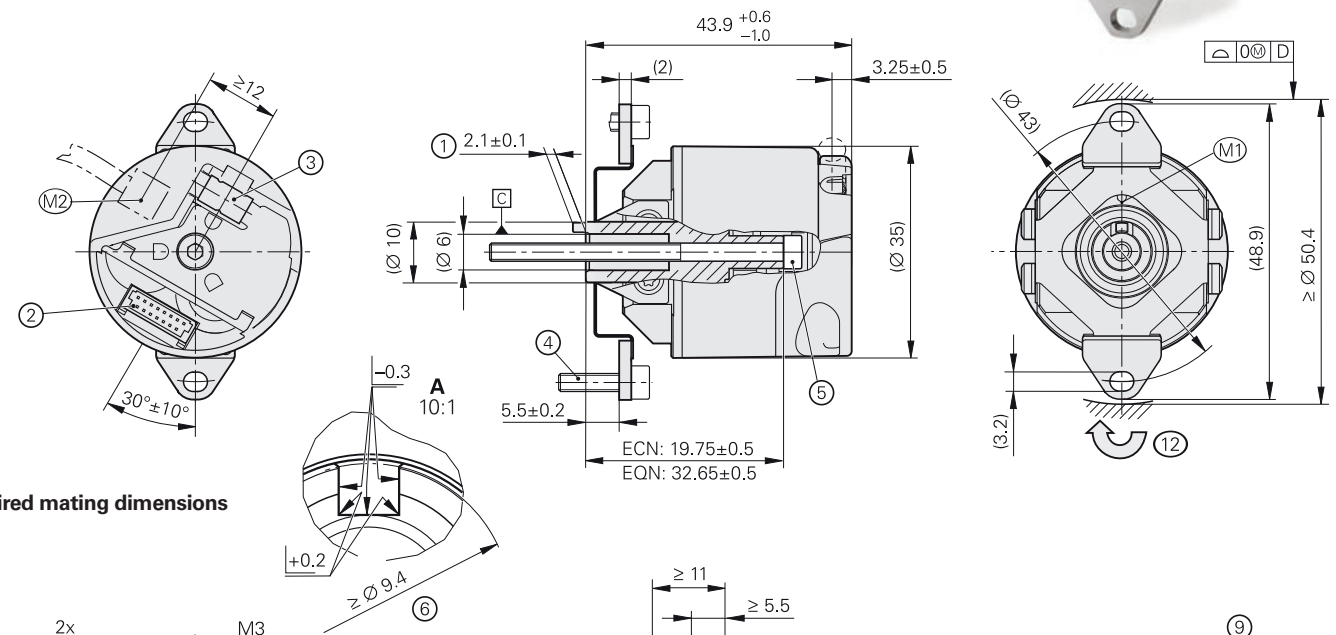
ECN 1123
EQN 1135

Absolute Rotary Encoders with 1KC Positive-Locking Hollow Shaft for Safety-Related Applications

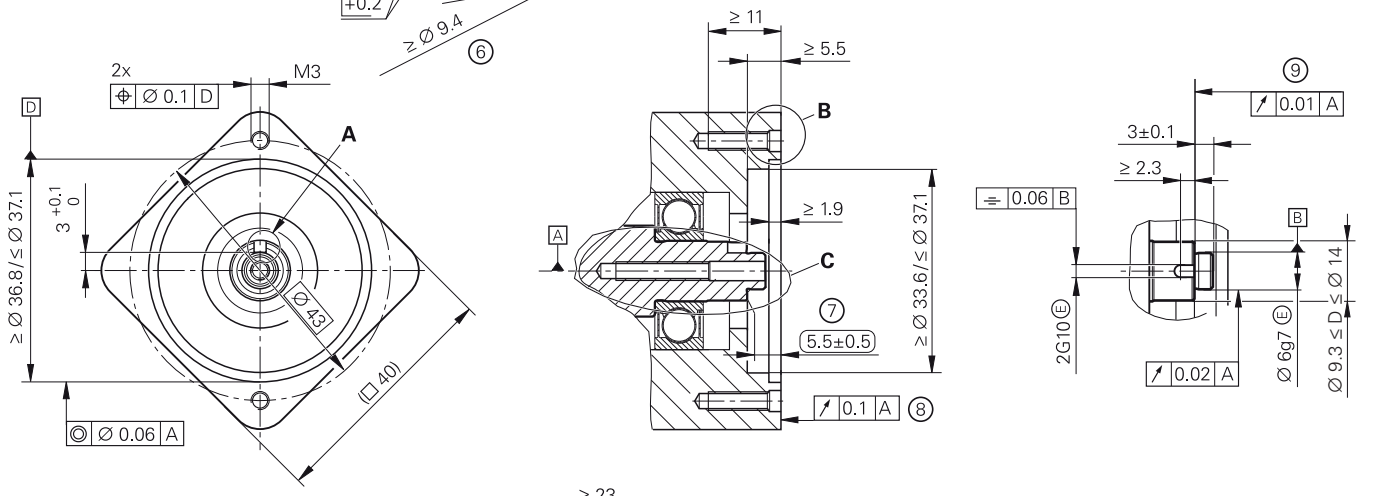
01/2023

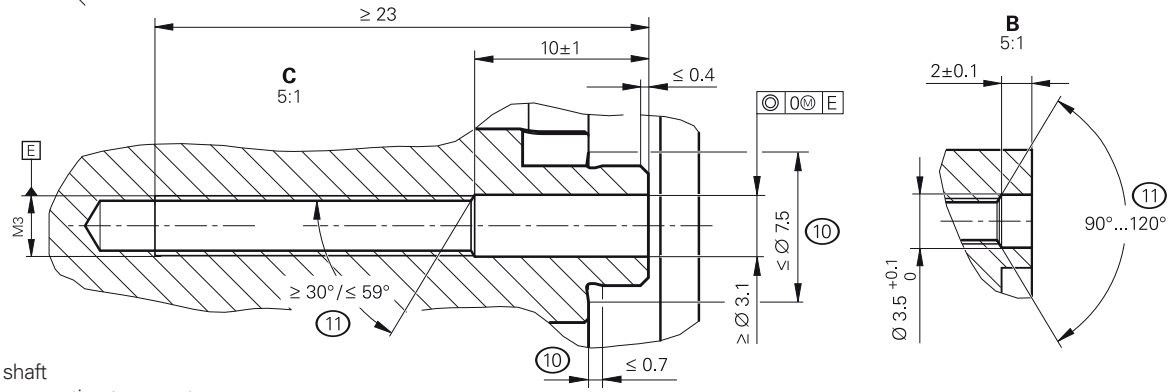
ECN 1123/EQN 1135 series

Rotary encoders for absolute position values with safe singleturn information
- **75A mounted stator coupling**
- **1KC blind hollow shaft for axial clamping**



Required mating dimensions





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

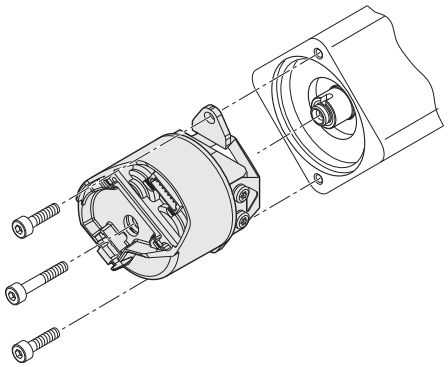
Ⓐ = Bearing of mating shaft
M1 = Measuring point for operating temperature
M2 = Measuring point for vibration
1 = Positive locking element; ensure correct engagement in slot.
2 = 15-pin PCB connector
3 = Fastening for cable with crimp sleeve Ø 4.3 mm ±0.1 mm – 7 mm long
4 = Screw: ISO 4762 M3x12 – 8.8 – MKL; tightening torque: 1.15 Nm ±0.05 Nm
5 = Screw: ISO 4762, ECN: M3x35 – 8.8 – MKL, EQN: M3x50 – 8.8 – MKL; tightening torque: 1.15 N ±0.05 Nm
6 = Contact surface of slot
7 = Maximum permissible deviation between the shaft surface and coupling surface; compensation of mounting tolerances and thermal expansion, of which ±0.15 mm of dynamic axial motion is permitted.
8 = Coupling surface
9 = Shaft surface; ensure that there is full-surface contact!
10 = Undercut
11 = Chamfer at start of thread is mandatory for material bonding anti-rotation lock
12 = Direction of shaft rotation for ascending position values

Specifications	ECN 1123 singleturn	EQN 1135 multiturn
Functional safety for applications with up to	As a single-encoder system for monitoring functions • SIL 1, as per EN 61508 (further basis for testing: IEC 61800-5-3) • Category 2, PL c as per EN ISO 13849-1:2015 As single-encoder system for closed-loop functions • SIL 2, as per EN 61508 (further basis for testing: IEC 61800-5-3) • Category 3, PL d, in accordance with EN ISO 13849-1:2015 Safe in the singleturn range	
PFH	≤ $15 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[1]	*Encoder:* ±1.76° (safety-related measuring step SM = 0.7°) *Mechanical coupling:* ±2° (fault exclusion for the loosening of the shaft coupling and stator coupling, designed for accelerations ≤ 300 m/s²)	
Interface/ordering designation	EnDat 2.2/EnDat22	
Position values per revolution	8388608 (23 bits)	
Revolutions	–	4096 (12 bits)
Calculation time t_{cal}/clock frequency	≤ 7 µs/≤ 8 MHz	
System accuracy at 20 °C	±60″	
Supply voltage	DC 3.6 V to 14 V	
Power consumption[2] (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:* 85 mA (without load)	*At 5 V:* 105 mA (without load)
Electrical connection	15-pin PCB connector (with connection for external temperature sensor[3])	
Cable length	≤ 100 m (see the EnDat description in the *Interfaces of HEIDENHAIN Encoders* brochure)	
Shaft	1KC blind hollow shaft (Ø 6 mm) with positive locking joint	
Shaft speed	≤ 12000 rpm	
Starting torque (typical)	≤ 0.001 Nm (at 20 °C)	≤ 0.002 Nm (at 20 °C)
Moment of inertia of rotor	$0.4 \cdot 10^{-6}$ kgm²	
Angular acceleration of rotor	≤ $0.8 \cdot 10^{5}$ rad/s²	
Natural frequency f_N (typical)	≥ 1000 Hz	
Axial motion of measured shaft	≤ ±0.5 mm	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 200 m/s² (EN 60068-2-6); 10 Hz to 55 Hz constant over 3.2 mm peak to peak ≤ 2000 m/s² (EN 60068-2-27)	
Operating temperature	–40 °C to 110 °C	
Trigger threshold for exceeded temperature error message[4]	125 °C (measuring accuracy of the internal temperature sensor: ±5 K)	
Relative humidity	≤ 93% (40 °C/21 d as per EN 60068-2-78), condensation excluded	
Protection rating EN 60529	IP40 (read about insulation under *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochure; contamination through the ingress of liquids must be avoided)	
Mass	≈ 0.1 kg	
ID number	743586-03	743587-03 743587-53 (collective packaging)

[1] Further tolerances may arise in the downstream electronics after position value comparison (contact mfr.)
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[3] Evaluation optimized for KTY 84-130 (see *Temperature measurement in motors* in the *Encoder for Servo Drives* brochure)
[4] The internal temperature evaluation is not designed for functional safety

Mounting

The blind hollow shaft of the rotary encoder is seated onto the measured shaft and fastened with a central screw. It is particularly important to ensure that the positive-locking element of the rotary encoder shaft securely engages the corresponding slot in the measured shaft. Mounting on the stator side is performed without a centering collar on a flat surface with two clamping screws. Use screws with material bonding anti-rotation lock (see *Mounting accessories*).



Further information:

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

Also comply with the other material properties in the *Encoders for Servo Drives* brochure (ID 208922-xx).

Mounting accessories

Screws

Screws (central screw, mounting screws) are not included in delivery. They can be ordered separately.

	Screws[1)]		Lot size
Central screw for ECN 1123	ISO 4762-**M3×35**-8.8-**MKL**	ID 202264-66	10 or 100
Central screw for EQN 1135	ISO 4762-**M3×50**-8.8-**MKL**	ID 202264-81	
Fastening screw for stator coupling	ISO 4762-**M3×12**-8.8-**MKL**	ID 202264-69	20 or 200

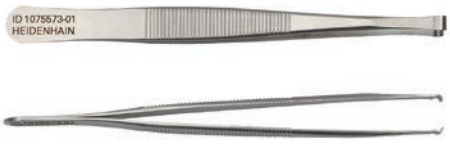
[1)] With coating for material bonding anti-rotation lock

Please note the information on screws from HEIDENHAIN in the *Encoders for Servo Drives* brochure, under the heading *Rotary encoders with functional safety* in the chapter *General mechanical information*

Mounting tool

The mounting aid is used for plugging and unplugging the PCB connector. It prevents damage to the cable by allowing force to be applied solely to the connector. The wires themselves must not be pulled.

ID 1075573-01



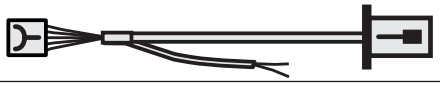
Mounting aid

The mounting aid allows the shaft of the rotary encoder to be turned from the rear of the device, making it easy to find the positive-locking connection between the encoder shaft and the measured shaft.

ID 821017-03

Electrical connection

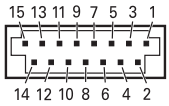
Cables

Output cables inside the motor housing		
With 15-pin PCB connector and 8-pin M12 flange socket (male); TPE wires in braided sleeve and wires for a temperature sensor		TPE 10 × 0.16 mm^2 [1] [2] ID 1117412-xx
With 15-pin PCB connector; Ø 3.7 mm EPG (with shield crimping Ø 4.5 mm) and wires for temperature sensor		EPG 1 × (4 × 0.06 mm^2) + 4 × 0.06 mm^2 [2] TPE 2 × 0.16 mm^2 ID 1108078-xx

[1] Wires with braided sleeve
[2] The shield connection must be implemented on the motor
Note on safety-related applications: Document the bit error rate in accordance with Specification 533095!

Pin layout

15-pin PCB connector



	Power supply				Serial data transmission				Other signals[1]	
	13	**11**	**14**	**12**	**7**	**8**	**9**	**10**	**5**	**6**
	U_P	Sensor **U_P**	**0 V**	Sensor **0 V**	**DATA**	**$\overline{\text{DATA}}$**	**CLOCK**	**$\overline{\text{CLOCK}}$**	**T+**[2]	**T–**[2]
	Brown/ Green	Blue	White/ Green	White	Gray	Pink	Violet	Yellow	Brown	Green

[1] Only with output cables inside the motor housing
[2] Connections for external temperature sensor; evaluation optimized for KTY 84-130 (see *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure)

Cable shield connected to housing; **U_P** = Power supply voltage
Sensor: The sense line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!
Note on safety-related applications: Only completely assembled HEIDENHAIN cables are qualified for this.
Do not modify cables or exchange their connectors without first consulting with HEIDENHAIN Traunreut!
Output cables with a cable length > 0.5 m require strain relief for the cable

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 document to ensure correct and intended operation:
- Operating Instructions 1390318