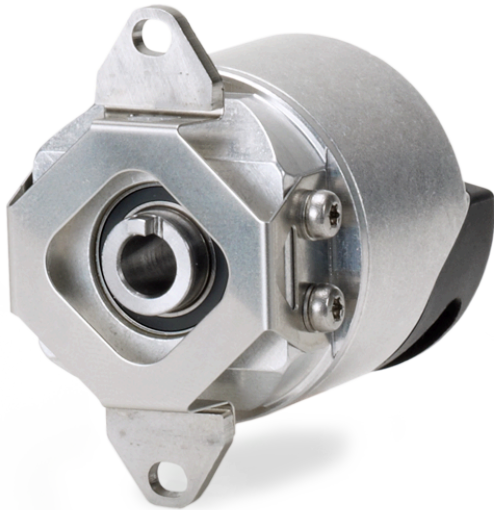




HEIDENHAIN



**Functional
Safety**

Product Information

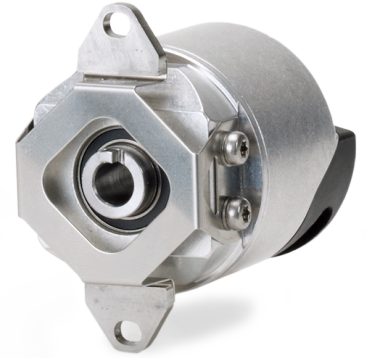
ECN 1123 EQN 1135

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

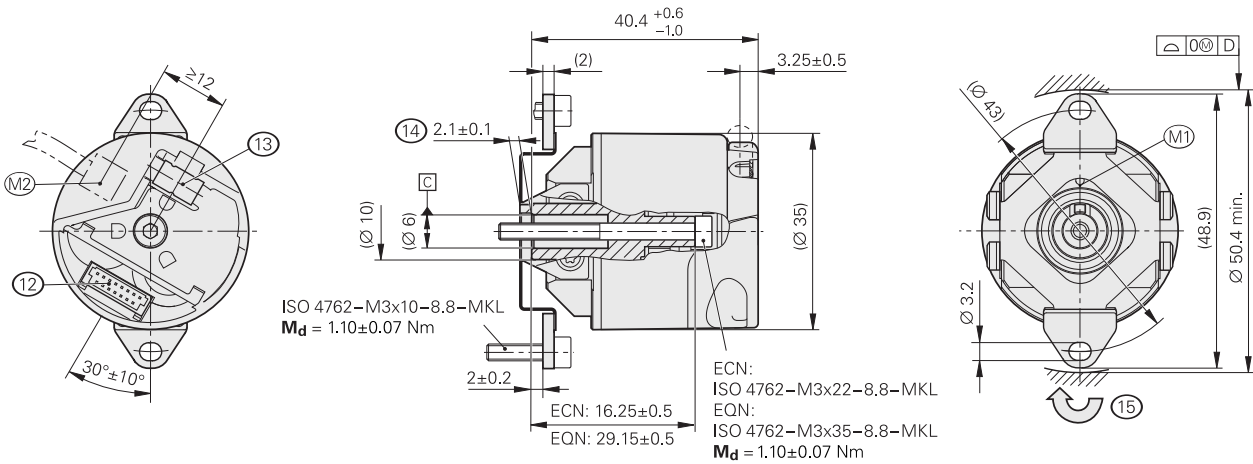
ECN 1123, EQN 1135

Rotary encoders for absolute position values with safe singleturn information

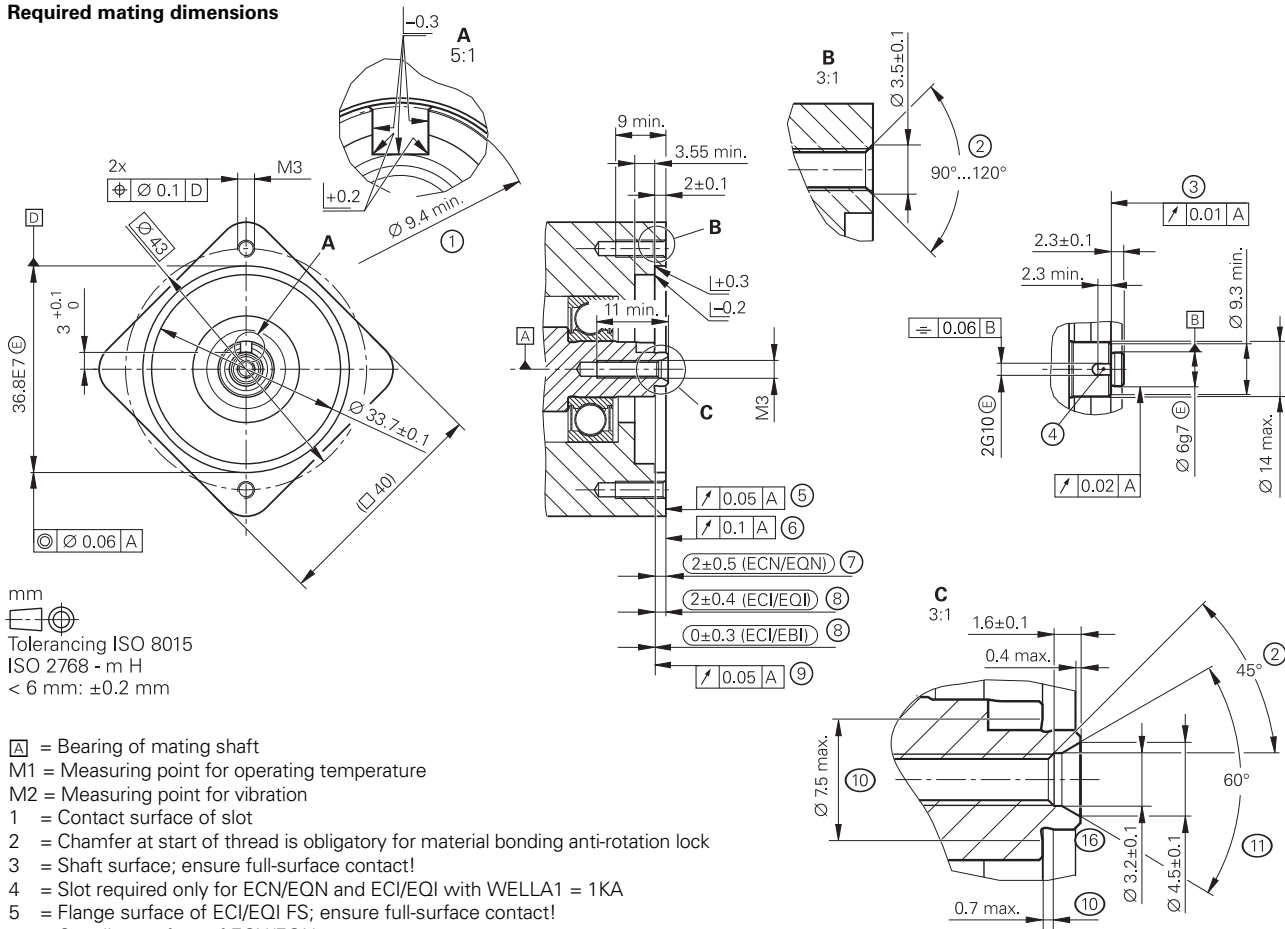
- 75A mounted stator coupling
- 1KA blind hollow shaft (Ø 6 mm) for axial clamping



Functional Safety



Required mating dimensions



- ⑫ = Bearing of mating shaft
- M1 = Measuring point for operating temperature
- M2 = Measuring point for vibration
- 1 = Contact surface of slot
- 2 = Chamfer at start of thread is obligatory for material bonding anti-rotation lock
- 3 = Shaft surface; ensure full-surface contact!
- 4 = Slot required only for ECN/EQN and ECI/EQI with WELLA1 = 1KA
- 5 = Flange surface of ECI/EQI FS; ensure full-surface contact!
- 6 = Coupling surface of ECN/EQN
- 7 = Maximum permissible deviation between the shaft surface and coupling surface; compensation for mounting tolerances and thermal expansion, of which ±0.15 mm of dynamic axial motion is permitted
- 8 = Maximum permissible deviation between the shaft surface and flange surface; compensation of mounting tolerances and thermal expansion
- 9 = Flange surface of ECI/EBI; ensure full-surface contact!
- 10 = Undercut
- 11 = Possible centering hole
- 12 = 15-pin PCB connector
- 13 = Fastening for cable with crimp sleeve; diameter: 4.3 mm ±0.1 mm; length: 7 mm
- 14 = Positive fit element; ensure correct engagement in slot 4 (e.g., by measuring the device overhang)
- 15 = Direction of shaft rotation for ascending position values
- 16 = Bare; shaft coating not permitted

Specifications	ECN 1123: singletum	EQN 1135: multitum
Functional safety for applications up to	As a single-encoder system for monitoring functions <ul style="list-style-type: none"> • SIL 1 as per EN 61508 (further basis for testing: EN 61800-5-2) • Category 2, PL c as per EN ISO 13849-1:2015 As a single-encoder system for control loop functions <ul style="list-style-type: none"> • 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 single-turn operation	
PFH	≤ 15 · 10 ⁻⁹ (probability of dangerous failure per hour)	
Safe position ¹⁾	<i>Encoder: ±1.75°</i> (safety-relevant measuring step SM = 0.7°) <i>Mechanical coupling: ±2°</i> (fault exclusion for the loosening of the shaft coupling and stator coupling; designed for accelerations of ≤ 300 m/s ²)	
Interface	EnDat 2.2	
Ordering designation	EnDat22	
Position values per revolution	8 388 608 (23 bits)	
Revolutions	-	4096 (12 bits)
Calculation time t _{cal} Clock frequency	≤ 7 μs ≤ 8 MHz	
System accuracy	±60"	
Electrical connection	15-pin PCB connector (with connector for external temperature sensor ³⁾)	
Cable length	≤ 100 m (see the EnDat description in the <i>Interfaces of HEIDENHAIN Encoders</i> brochure)	
Supply voltage	DC 3.6 V to 14 V	
Power consumption ²⁾ (max.)	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)
Shaft	1KA blind hollow shaft Ø 6 mm with positive-fit element	
Speed	≤ 12 000 rpm	
Starting torque ⁴⁾ at 20 °C	≤ 0.001 Nm	≤ 0.002 Nm
Moment of inertia	<i>Rotor:</i> 0.4 · 10 ⁻⁶ kgm ² ; <i>stator:</i> 1.0 · 10 ⁻⁵ kgm ²	
Angular acceleration	<i>Rotor:</i> ≤ 1 · 10 ⁵ rad/s ² ; <i>stator:</i> ≤ 1 · 10 ⁴ rad/s ²	
Axial motion of measured shaft	≤ ±0.5 mm	
Natural frequency of stator coupling	≥ 1000 Hz	
Vibration 55 Hz to 2000 Hz Shock 6 ms	≤ 200 m/s ² (EN 60068-2-6); 10 Hz to 55 Hz, 3.2 mm constant peak to peak ≤ 2000 m/s ² (EN 60068-2-27)	
Operating temperature	-40 °C to 110 °C	
Trigger threshold of error message for temperature exceedance	125 °C (measuring accuracy of the internal temperature sensor: ±5 K)	
Relative humidity	≤ 93 % (40 °C/21 d as per EN 60068-2-78); without condensation	
Protection EN 60529	IP40 (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	≈ 0.1 kg	
ID number	743586-01 743586-51 (collective package)	743587-01 743587-51 (collective package)

- 1) Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
- 2) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
- 3) See *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure
- 4) For the design of the mechanical fault exclusion, consider the maximum torque (page 4)

Mounting

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

For the customer-side mounting design, the material properties and conditions in accordance with the *General mechanical information* in the *Encoders for Servo Drives* brochure must be complied with. The materials data for aluminum and steel apply both to the customer's shaft and stator.

For the design of the mechanical fault exclusion for the shaft connection, the following maximum torque M_{\max} must be considered:

$$M_{\max} = 1.0 \text{ Nm}$$

The customer's mechanical design must ensure that the maximum torque M_{\max} occurring in the application can be transmitted.

Mounting accessories

Screws

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

	Screws ¹⁾		Lot size
Central screw for ECN 1123	ISO 4762-M3×22-8.8-MKL	ID 202264-65	10 or 100 pieces
Central screw for EQN 1135	ISO 4762-M3×35-8.8-MKL	ID 202264-66	
Mounting screw for flange	ISO 4762-M3×10-8.8-MKL	ID 202264-87	20 or 200 pieces

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 *Screws with material bonding anti-rotation lock* in the chapter *General mechanical information*.

Mounting aid

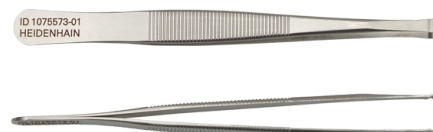
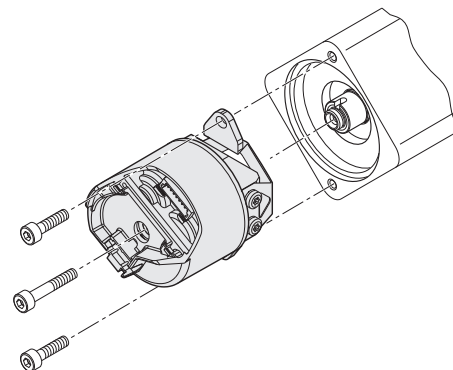
To avoid damage to the cable, use the mounting aid to connect and disconnect the cable assembly. The pulling force must be applied only to the connector of the cable assembly and not to the wires.



ID 1075573-01

Mounting aid

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

ID 821017-03


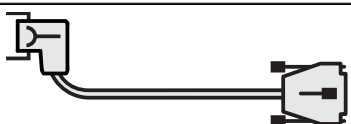


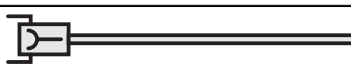
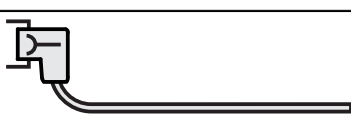


Output cables inside the motor housing		
With 15-pin PCB connector and 8-pin M12 flange socket (male); TPE wires in braided sleeve and wires for a temperature sensor		TPE $10 \times 0.16 \text{ mm}^2$ ¹⁾²⁾ ID 1117412-xx
With 15-pin PCB connector and unstripped cable end; $\varnothing 3.7 \text{ mm}$ EPG (with shield crimp $\varnothing 4.3 \text{ mm}$) and wires for a temperature sensor		EPG $1 \times (4 \times 0.06 \text{ mm}^2) + 4 \times 0.06 \text{ mm}^2$ ²⁾ TPE $2 \times 0.16 \text{ mm}^2$ ID 1108078-xx

1) Individual wires with braided sleeve

2) The shield connection must be implemented on the motor. Electromagnetic compatibility must be ensured in the complete system.

Note for safety-related applications: Document the bit error rate in accordance with Specification 533095!

PUR adapter cables and connecting cables $\varnothing 6 \text{ mm}$; $2 \times (2 \times 0.09 \text{ mm}^2) + 2 \times (2 \times 0.16 \text{ mm}^2)$; $A_P = 0.16 \text{ mm}^2$	8-pin M12 connector	
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male) for the IK 215, PWM 21, EIB 741, etc.		ID 1036526-xx
Adapter cable with 8-pin M12 right-angle connector (female) and 15-pin D-sub connector (male) for the IK 215, PWM 21, EIB 741, etc.		ID 1133855-xx
Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		ID 1036372-xx
Connecting cable with 8-pin M12 right-angle connector (female) and 8-pin M12 coupling (male)		ID 1036386-xx
Connecting cable with 8-pin M12 connector (female) and unstripped cable end		ID 1129581-xx ¹⁾
Connecting cable with 8-pin M12 right-angle connector (female) and unstripped cable end		ID 1133799-xx ¹⁾

A_P : Cross section of power supply lines


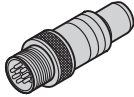

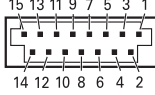






1) Use connecting elements for 8 MHz signal transmission

Note for safety-related applications:

- Document the bit error rate in accordance with Specification 533095!
- Electromagnetic compatibility must be ensured in the complete system.

Electrical connection: pin layout

Pin layout

Coupling or 8-pin M12 flange socket		15-pin PCB connector									
											
	Power supply				Serial data transmission				Other signals ¹⁾		
 M12	8	2	5	1	3	4	7	6	/	/	
 15	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 for output cables within 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!

Output cables with a cable length of greater than 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 made.



Further information: Comply with the requirements described in the following documents to ensure correct operation of the encoder:

- *Encoders for Servo Drives* brochure: 208922-xx
- *ECN 1123, EQN 1135* Mounting Instructions: 816487-xx
- *Safety-Related Position Measuring Systems* Technical Information: 596632
- For implementation in a safe control or inverter: *Specification 533095*