



HEIDENHAIN



**Functional
Safety**

Product Information

ECI 1319

EQI 1331

EBI 1335

Absolute Rotary Encoders
without Integral Bearing

With additional measures:
suitable for safety-related
applications with up to SIL 3

09/2022

Specifications	ECI 1319 singletum	EQI 1331 multitum	EBI 1335 multitum
ID number	810661-02 (shaft 44C) 810661-03 (shaft 44A) 810661-06 (shaft 44C) ¹⁾	810662-01 (shaft 44A) 810662-03 (shaft 44C) 810662-06 (shaft 44C) ¹⁾	1230275-01 (shaft 44C) 1230275-02 (shaft 44A)
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 With additional measures as per Document 1000344, suitable for safety-related applications with up to SIL 3 or Category 4, PL e Safe in the singletum range		
PFH	SIL 2: $\leq 15 \cdot 10^{-9}$ (probability of dangerous failure per hour) SIL 3: $\leq 2 \cdot 10^{-9}$		
Safe position ²⁾	Encoder: $\pm 0.88^\circ$ (safety-relevant measuring step SM = 0.35°) Mechanical coupling: $\pm 0^\circ$; (fault exclusion for the loosening of the shaft coupling and stator coupling, designed for accelerations at the stator of $\leq 400 \text{ m/s}^2$; at the rotor of $\leq 600 \text{ m/s}^2$)		
Interface	EnDat 2.2		
Ordering designation	EnDat22		
Position values per revolution	524288 (19 bits)		
Revolutions	–	4096 (12 bits)	65563 (16 bits)
Calculation time t_{cal} Clock frequency	$\leq 5 \mu\text{s}$ $\leq 16 \text{ MHz}$		
System accuracy	$\pm 65''$		
Electrical connection	16-pin PCB connector (with connection for external temperature sensor)		
Cable length	$\leq 100 \text{ m}$ (see EnDat description in the <i>Interfaces of HEIDENHAIN Encoders</i> brochure)		
Supply voltage	DC 3.6 V to 14 V		Rotary encoder U_P : DC 3.6 V to 14 V Buffer battery U_{Bat} : DC 3.6 V to 5.25 V
Power consumption ³⁾ (maximum)	At 3.6 V: $\leq 650 \text{ mW}$ At 14 V: $\leq 700 \text{ mW}$	At 3.6 V: $\leq 750 \text{ mW}$ At 14 V: $\leq 850 \text{ mW}$	At 3.6 V: $\leq 650 \text{ mW}$ At 14 V: $\leq 700 \text{ mW}$
Current consumption (typical)	At 5 V: 95 mA (without load)	At 5 V: 115 mA (without load)	Normal operation at 5 V: 95 mA (without load) Buffer mode: 160 μA (rotating shaft) ⁴⁾ 16 μA (at standstill)

¹⁾ In collective package

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

³⁾ See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure or at www.heidenhain.com

⁴⁾ At $T = 25^\circ\text{C}$; $U_{\text{Bat}} = 3.6 \text{ V}$

Specifications	ECI 1319 singletum	EQI 1331 multitum	EBI 1335 multitum
Shaft*	Blind hollow shaft for axial clamping \varnothing 12.7 mm (44C) or \varnothing 12 mm (44A)		
Shaft speed	≤ 15000 rpm	≤ 12000 rpm	
Moment of inertia of rotor	$2.45 \cdot 10^{-6}$ kgm ²	$2.6 \cdot 10^{-6}$ kgm ²	$2.45 \cdot 10^{-6}$ kgm ²
Angular acceleration of rotor	$\leq 1 \cdot 10^5$ rad/s ²		
Axial motion of measured shaft	$\leq \pm 0.5$ mm		
Vibration 55 Hz to 2000 Hz ¹⁾ Shock: 6 ms	Stator: ≤ 400 m/s ² ; rotor: ≤ 600 m/s ² (EN 60068-2-6) ≤ 2000 m/s ² (EN 60068-2-27)		
Operating temperature	-40 °C to 115 °C		
Trigger threshold of error message for excessive temperature	130 °C (measuring accuracy of internal temperature sensor: ± 1 K)		
Relative humidity	$\leq 93\%$ (40 °C/21 d as per EN 60068-2-78), condensation excluded		
Protection EN 60529	IP20		
Mass	≈ 0.13 kg		

* Please select when ordering

¹⁾ 10 Hz to 55 Hz constant over 4.9 mm peak to peak

Mounting

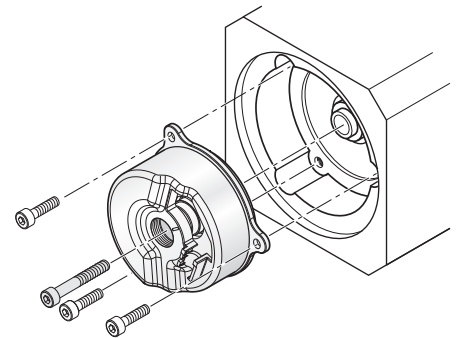
The blind hollow shaft of the rotary encoder is pressed onto the measured shaft and fastened with a central screw. Mounting on the stator side is performed via a centering diameter with three mounting screws. Use screws with material bonding anti-rotation lock (see *Mounting accessories*).



More information:

A steel mating shaft and aluminum mating stator are assumed for the fault exclusion design for functional safety.

Take into account the material specifications and other material characteristics in the *Encoders for Servo Drives* brochure.



Mounting accessories

Screws

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

ECN 1319 EQN 1331 EBI 1335	Screws ¹⁾		Lot size
Central screw for shaft fastening	DIN 6912 – M5x30 – 08.8 – MKL	ID 202264-76	10 or 100
Fastening screw for flange	ISO 4762 – M4x10 – 8.8 – MKL	ID 202264-85	30 or 300

¹⁾ With coating for material bonding anti-rotation lock

Please note the information about 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

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


ID 1075573-01



For more mounting information and mounting aids, see the Mounting Instructions and the *Encoders for Servo Drives* brochure. The installation can be inspected with the PWM 21 and the ATS software (see Document 1082415).

Electrical connection





Cables

EPG output cable inside the motor \varnothing 3.7 mm (with shield crimping \varnothing 6.1 mm); 1 x (4 x 0.06 mm ²) + 4 x 0.06 mm ² and TPE wires 2 x 0.16 mm ² for temperature sensor		
With 16-pin PCB connector and 9-pin M23 SpeedTEC angle flange socket (male)		ID 1120948-xx

Note for safety-related applications:

- Document the bit error rate in accordance with Specification 533095!
- CE compliance of the complete system must be documented!

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PUR adapter cables and connecting cable \varnothing 6 mm; (4 x 0.14 mm ²) + (4 x 0.34 mm ²); A _P = 0.34 mm ²	8-pin M12 connector	9-pin M23 connector	
Connecting cable with 9-pin M23 connector (female) and 8-pin M12 coupling (male)		-	ID 745796-xx
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (female)			ID 533627-xx
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male)			ID 524599-xx
Connecting cable with 8-pin M12 connector (female) and stripped cable end			ID 634265-xx ¹⁾


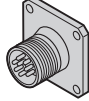


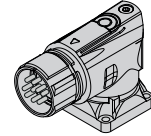

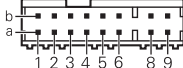





A_P: Cross section of the supply wires

¹⁾ Connecting elements must be suitable for the maximum clock frequency used

Note for safety-related applications:

- Document the bit error rate as per specification 533095!
- CE compliance of the complete system must be documented!

Pin layout of ECI, EQI

8-pin coupling or 8-pin M12 flange socket   					9-pin M23 SpeedTEC angle flange socket   					
16-pin PCB connector   16										
	Power supply				Serial data transmission				Other signals	
 M12	8	2	5	1	3	4	7	6	/	/
 M23	3	7	4	8	5	6	1	2	/	/
 16	1b	6a	4b	3a	6b	1a	2b	5a	8a	8b
	U_P	Sensor U_P	0V	Sensor 0V	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$	T^+ ¹⁾	T^- ¹⁾
	Brown/ Green	Blue	White/ Green	White	Gray	Pink	Violet	Yellow	Brown	Green

¹⁾ 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 = Supply voltage


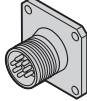
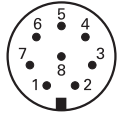

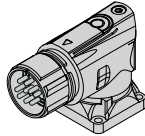
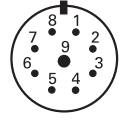
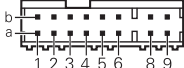





Sensor: The sense line is connected in the encoder with the corresponding power line

Vacant pins or wires must not be used!

Note 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.

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Pin layout of EBI

8-pin coupling or 8-pin M12 flange socket   				9-pin M23 SpeedTEC angle flange socket   						
16-pin PCB connector   16										
	Power supply				Serial data transmission				Other signals	
 M12	8	2	5	1	3	4	7	6	/	/
 M23	3	7	4	8	5	6	1	2	/	/
 16	1b	6a	4b	3a	6b	1a	2b	5a	8a	8b
	U_P	U_{BAT}	$0V^{1)}$	$0V_{BAT}$	DATA	\overline{DATA}	CLOCK	\overline{CLOCK}	$T+^{2)}$	$T-^{2)}$
	Brown/ Green	Blue	White/ Green	White	Gray	Pink	Violet	Yellow	Brown	Green

¹⁾ Connected inside the encoder

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 = 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 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.

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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 the correct and intended operation of the encoder:

- Operating Instructions 1384976
- Technical Information: *Safety-related position measurement systems*: 596632
- For implementation in a safe control system or inverter: *Specification*: 533095
- and *Supplementary Measures Catalog* (SIL 3, PL e): 1000344