HEIDENHAIN

ECN 1325
EQN 1337

Absolute Rotary Encoders
with Tapered Shaft for
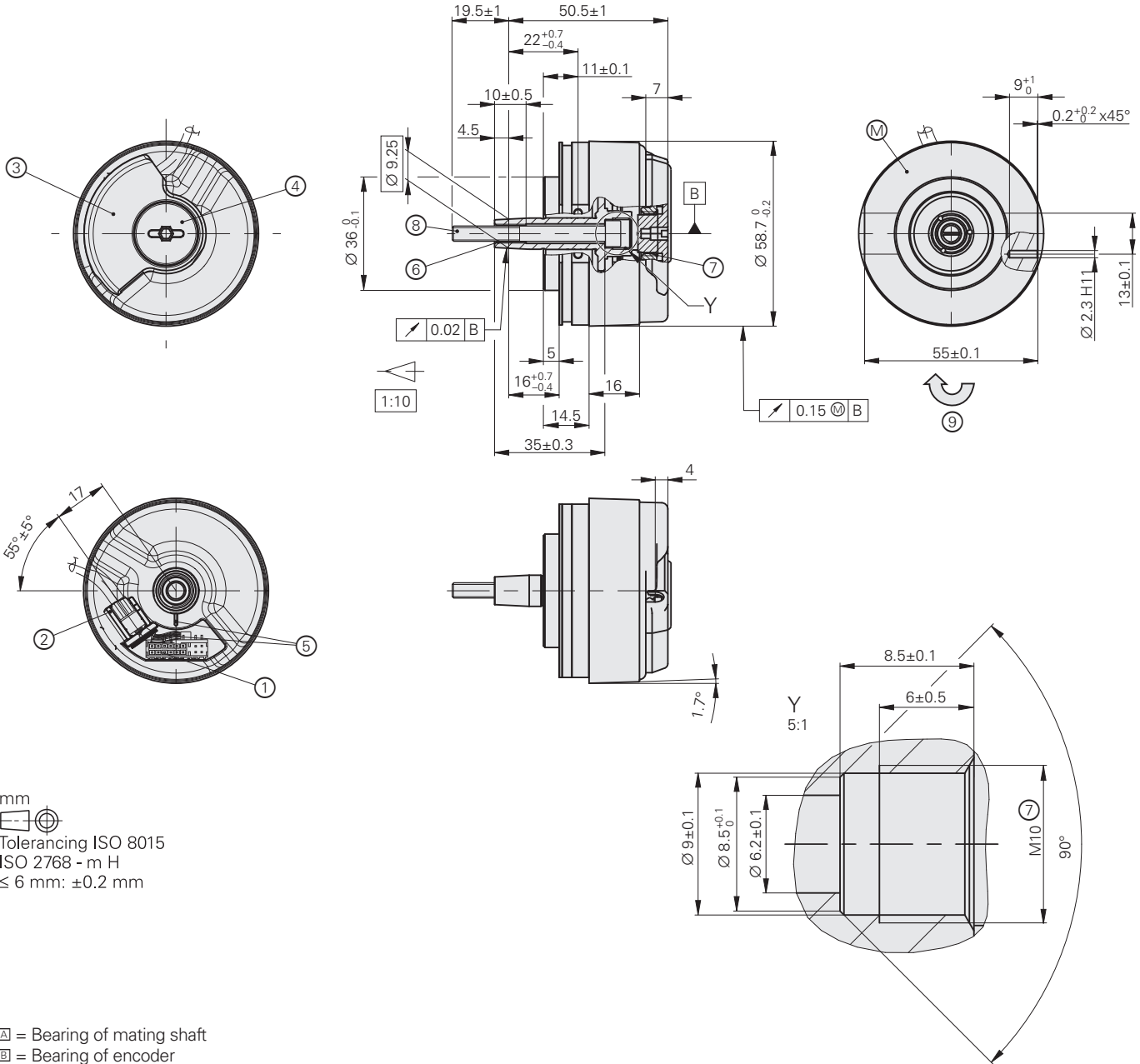Safety-Related Applications

Functional
Safety

ECN 1325/EQN 1337 series

Rotary encoders for absolute position values with safe singleturn information
- **24 flange**
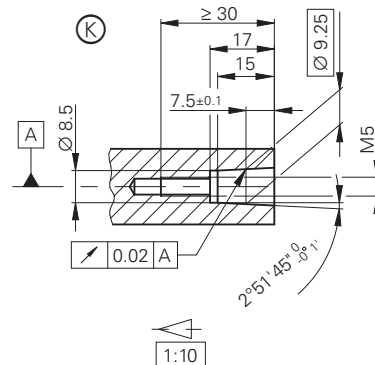- **Without stator coupling**
- **65B tapered shaft**

Functional Safety

mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm

Ⓐ = Bearing of mating shaft
Ⓑ = Bearing of encoder
K = Required mating dimensions
M = Measuring point for operating temperature
1 = 16-pin PCB connector
2 = Cable gland with crimp sleeve ∅ 6 +0.3 x 10
3 = Die-cast cover
4 = Screw plug, width A/F 3 and 4, tightening torque: 5 Nm +0.5 Nm
5 = Zero position for shaft and cap
6 = M6 back-off thread
7 = M10 back-off thread
8 = Self-locking screw: DIN 6912 – M5x50 – 08.8 – MKL, width A/F 4, tightening torque: 5 Nm +0.5 Nm
9 = Direction of shaft rotation for ascending position values

Product Information ECN 1325, EQN 1337   05/2019

Specifications	ECN 1325 – singleturn	EQN 1337 – multiturn
Functional safety for applications with up to	As single-encoder system for monitoring functions • 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 single-encoder system for closed-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	$\leq 15 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[1]	*Encoder:* ±1.76° (safety-relevant measuring step SM = 0.7°); *mechanical coupling:* no fault exclusion for the stator coupling from HEIDENHAIN	
Interface	EnDat 2.2	
Ordering designation	EnDat22	
Position values per revolution	33 554 432 (25 bits)	
Revolutions	–	4096 (12 bits)
Calculation time t_{cal} Clock frequency	≤ 7 µs ≤ 8 MHz	
System accuracy	±20″	
Electrical connection	PCB connector on encoder: 16-pin, with connection for temperature sensor[2]	
Cable length	≤ 100 m (see EnDat description in the *Interfaces of HEIDENHAIN Encoders* brochure)	
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:* 85 mA (without load)	*At 5 V:* 105 mA (without load)

[1] Further tolerances may apply in subsequent electronics after position value comparison (contact the mfr. of the subsequent electronics)
[2] See *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure
[3] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

Specifications	ECN 1325 – singleturn	EQN 1337 – multiturn
Shaft	Tapered shaft $\varnothing$ 9.25 mm; taper 1:10 (65B)	
Shaft load	*Axial:* $\leq$ 15 N; *radial:* $\leq$ 90 N (*maximum occurring load on the rotary encoder bearing:* stator-side force exerted through the torque support; the fastening point of the torque support in the bearing shield is axially located 10 mm from $\varnothing$ 9.25 mm toward the rotary encoder)	
Speed	$\leq$ 15 000 rpm	$\leq$ 12 000 rpm
Starting torque at 20 °C	$\leq$ 0.01 Nm	
Moment of inertia of rotor	$2.6 \cdot 10^{-6}$ kgm^2	
Angular acceleration of rotor	$\leq 1 \cdot 10^5$ rad/s^2	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	$\leq$ 300 m/s^2 [1] (EN 60068-2-6); 10 Hz to 55 Hz constant over 4.9 mm peak to peak $\leq$ 2000 m/s^2 (EN 60068-2-27)	
Operating temperature	–40 °C to 115 °C	
Trigger threshold for temperature exceedance error message	125 °C (measuring accuracy of internal temperature sensor: ±4 K)	
Relative humidity	$\leq$ 93 % (40 °C/21 d as per EN 60068-2-78); without condensation	
Protection EN 60529	IP40 (read about "isolation" under *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochure; contamination from the ingress of fluids must be avoided)	
Mass	$\approx$ 0.25 kg	
ID number	1280359-01[2]	1280360-02[2]

[1] Valid as per standard at room temperature; the following applies at an operating temperature of up to 100 °C: $\leq$ 300 m/s^2; up to 115 °C: $\leq$ 150 m/s^2

[2] Rotary encoders in collective package

Information for the fault exclusion design of the rotor coupling and stator coupling

For the design of the mechanical fault exclusion for the shaft connection, consider the following maximum torque M_{max}:
M_{max} = 1.0 Nm

Mounting accessories

Screws

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

ECN 1325, EQN 1337	Screws[1]		Quantity
Central screw for shaft fastening	DIN 6912-**M5×50**-08.8-**MKL**	ID 202264-54	10 or 100 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 section *Screws with material bonding anti-rotation lock* in the chapter *General mechanical information.*

Mounting aid

The mounting aid is used for insertion and removal of 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

For further mounting information and mounting aids, please refer to the relevant mounting instructions and the *Encoders for Servo Drives* brochure.
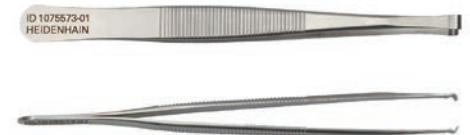
Integrated temperature evaluation

This rotary encoder features a temperature sensor integrated into the encoder electronics and an evaluation circuit for an external temperature sensor. In both cases, the respective digitalized temperature value is transmitted purely serially over the EnDat protocol. Bear in mind that neither the temperature measurement nor its transmission is safe in terms of functional safety.

With regard to the internal temperature sensor, the encoder supports the two-stage cascaded signaling of a temperature exceedance. This consists of an EnDat warning and an EnDat error message.

In compliance with the EnDat specification, when the temperature reaches the warning threshold for the temperature exceedance of the internal temperature sensor, an EnDat warning is issued (EnDat memory area "Operating status," word 1 "Warnings," bit 21 "Temperature exceeded"). This warning threshold for the internal temperature sensor is stored in the EnDat memory area "Operating parameters," word 6 "Trigger threshold warning bit for excessive temperature," and can be individually adjusted. A product-specific default value is saved before shipping. The temperature measured by the internal temperature sensor is higher by a device-specific and application-specific amount than the temperature at measuring point M1 in accordance with the dimension drawing.

The encoder features a further, albeit non-adjustable, trigger threshold of the internal temperature sensor, which, when exceeded, triggers an EnDat error message (the EnDat memory area "Operating status," word 0 "Error messages," bit 22 "Position," and in additional data 2 "Operating status error sources," bit 26 "Temperature exceeded"). This trigger threshold may vary depending on the device and is provided in the specifications.

HEIDENHAIN recommends adjusting the warning threshold based on the application such that this threshold is sufficiently below the trigger threshold for the "Temperature exceeded" EnDat error message. The encoder's intended use requires compliance with the operating temperature at measuring point M1.

Output cables inside the motor housing with temperature sensor wires (TPE 2×0.16 mm^2)		
With 16-pin PCB connector and 9-pin M23 right-angle socket (male)		1120948-xx EPG $1 \times (4 \times 0.06$ mm$^2) + 4 \times 0.06$ mm^2
With 16-pin PCB connector and 8-pin M12 flange socket (male)		1117280-xx[1] TPE 8×0.16 mm^2

[1] **Information for safety-related applications:**
Document the bit error rate in accordance with Specification 533095!
The electromagnetic compatibility of the complete system must be ensured.

PUR connecting cable Ø 6 mm		
With 8-pin M12 connector (female) and 8-pin M12 coupling (male)		ID 368330-xx
		$(4 \times 0.14$ mm$^2) + (4 \times 0.34$ mm$^2)$ $A_P = 0.34$ mm^2
With 9-pin M12 connector (female) and 9-pin M23 coupling (male)		ID 1136863-xx
		$2 \times (2 \times 0.09$ mm$^2) + 2 \times (2 \times 0.16$ mm$^2)$ $A_P = 0.16$ mm^2
With 8-pin M12 connector (female) and 15-pin D-sub connector (female)		ID 1036521-xx
		$2 \times (2 \times 0.09$ mm$^2) + 2 \times (2 \times 0.16$ mm$^2)$ $A_P = 0.16$ mm^2
With 8-pin M12 connector (female) and 15-pin D-sub connector (male)		ID 1036526-xx
		$2 \times (2 \times 0.09$ mm$^2) + 2 \times (2 \times 0.16$ mm$^2)$ $A_P = 0.16$ mm^2
With 8-pin M12 connector (female) and free cable end		ID 634265-xx[1]
		$(4 \times 0.14$ mm$^2) + (4 \times 0.34$ mm$^2)$ $A_P = 0.34$ mm^2

A_P: Cross section of power supply lines
[1] Connecting element must be suitable for the maximum clock frequency used.
   Note for safety-related applications:
   Document the bit error rate in accordance with Specification 533095!
The electromagnetic compatibility of the complete system must be ensured.
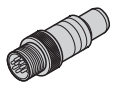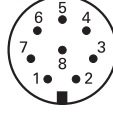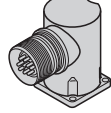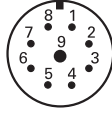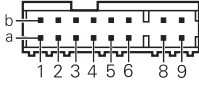
Electrical connection

Pin layout

8-pin M12 coupling or flange socket	9-pin M23 right-angle socket

16-pin PCB connector		

	Power supply				Serial data transfer				Other signals[1]	
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	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 adapter 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; **T** = temperature
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 made.

📖 **More information:**

Comply with the requirements described in the following documents to ensure the correct operation:
- Brochure: *Encoders for Servo Drives* — 208922-xx
- Mounting instruction: *ECN 1325, EQN 1337* — 1280889-xx
- Technical Information document: *Safety-Related Position Measuring Systems* — 596632
- For implementation in a safe control or inverter: *Specification* — 533095
- Brochure: *Interfaces of HEIDENHAIN Encoders* — 1078628-xx
- Brochure: *Cables and Connectors* — 1206103-xx