



# HEIDENHAIN



**Functional  
Safety**

Product Information

## **ECN 1325 EQN 1337**

Absolute Rotary Encoders  
with Tapered Shaft for  
Safety-Related Applications

For HMC 2 connection  
technology

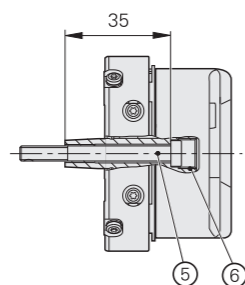
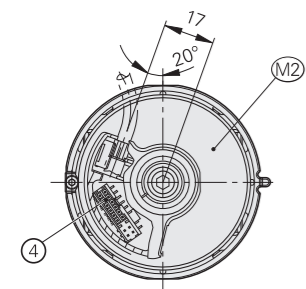
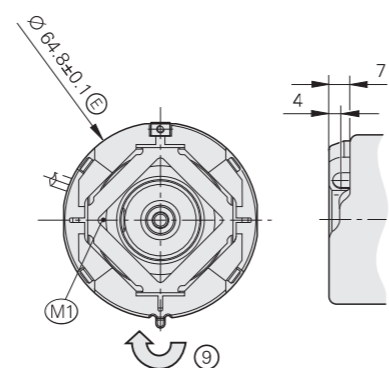
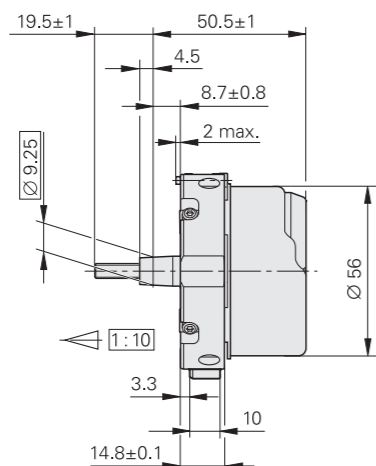
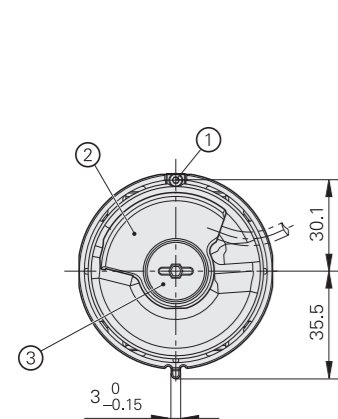
# ECN 1325, EQN 1337

**Rotary encoders for absolute position feedback with safe singleturn information**

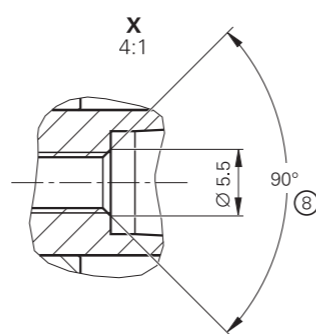
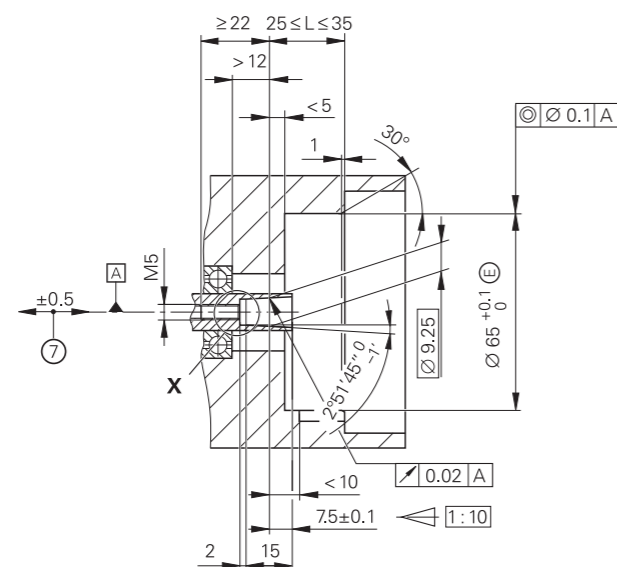
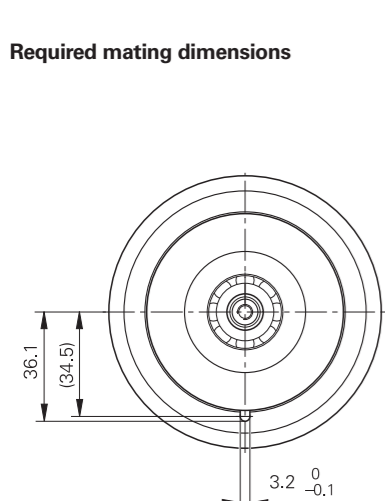
- 65 mm installation diameter
- 07B expanding ring coupling
- 65B tapered shaft



**Functional Safety**



## 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 (see D741714)
- 1 = Clamping screw for coupling ring; width A/F 2; tightening torque: 1.25 Nm –0.2 Nm
- 2 = Die-cast cover
- 3 = Screw plug; widths A/F 3 and 4; tightening torque: 5 Nm +0.5 Nm
- 4 = 16-pin header (12+4-pin)
- 5 = Screw: DIN 6912 – M5x50 – 08.8 – MKL; width A/F 4; tightening torque: 5 Nm +0.5 Nm
- 6 = M10 back-off thread
- 7 = Compensation of mounting tolerances and thermal expansion; no dynamic movement permitted
- 8 = Chamfer at start of thread is mandatory for material bonding anti-rotation lock
- 9 = Direction of shaft rotation for ascending position values

Specifications	ECN 1325 singleturn	EQN 1337 multiturn
<b>Functional safety</b> for applications with up to	As a single-encoder system for monitoring functions and closed-loop functions • 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 Safe in the singleturn range	
PFH <sup>1)</sup>	≤ 20 · 10 <sup>-9</sup> (probability of dangerous failure per hour)	
Safe position <sup>2)</sup>	<i>Encoder</i> : ±2.12° (safety-related measuring step: SM = 0.7°) <i>Mechanical coupling</i> : ±2° (fault exclusion for the loosening of the shaft coupling and stator coupling, designed for accelerations ≤ 300 m/s <sup>2</sup> )	
<b>Interface</b>	EnDat 3	
Ordering designation	E30-R2	
Position values per revolution	33554432 (25 bits)	
Revolutions	–	4096 (12 bits)
XEL.time HPFout data rate	≤ 11 µs at 12.5 Mbit/s; ≤ 8.2 µs at 25 Mbit/s	
<b>System accuracy</b>	±20''	
<b>Electrical connection</b>	<i>PCB connector</i> : 16-pin (12+4-pin), with connection for external temperature sensor <sup>3)</sup>	
Cable length	At 12.5 Mbit/s: ≤ 100 m; at 25 Mbit/s: ≤ 40 m	
Supply voltage	DC 4 V to 14 V (recommended: 12 V)	
Power consumption <sup>4)</sup> (maximum)	At 4 V: ≤ 700 mW; at 14 V: ≤ 750 mW	At 4 V: ≤ 800 mW; at 14 V: ≤ 850 mW
Current consumption (typical)	At 12 V: 30 mA (without communication)	At 12 V: 40 mA (without communication)
<b>Shaft</b>	65B tapered shaft Ø 9.25 mm; taper 1:10	
Shaft speed	≤ 15000 rpm	≤ 12000 rpm
Starting torque at 20 °C	≤ 0.01 Nm	
Moment of inertia of rotor	2.6 · 10 <sup>-6</sup> kgm <sup>2</sup>	
Angular acceleration of rotor	≤ 1 · 10 <sup>5</sup> rad/s <sup>2</sup>	
Natural freq. of stator coupling	1800 Hz (typical)	
Axial motion of measured shaft	≤ ±0.5 mm	
<b>Vibration</b> 55 Hz to 2000 Hz	≤ 300 m/s <sup>2 5)</sup> (EN 60068-2-6); 10 Hz to 55 Hz constant over 4.9 mm peak to peak	
<b>Shock</b> 6 ms	≤ 2000 m/s <sup>2</sup> (EN 60068-2-27)	
<b>Operating temperature</b>	–40 °C to 115 °C	
<b>Trigger threshold</b> for exceeded temperature error message	125 °C (measuring accuracy of internal temperature sensor: ±1 K)	
<b>Relative humidity</b>	≤ 93% (40 °C/21 d as per EN 60068-2-78), condensation excluded	
<b>Protection rating</b> 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)	
<b>Mass</b>	≈ 0.3 kg	
<b>Part number</b>	ID 1296522-01/-53 <sup>6)</sup>	ID 1296523-01/-53 <sup>6)</sup>

<sup>1)</sup> For use at ≤ 2000 m above sea level (≤ 6000 m above sea level upon request)

<sup>2)</sup> Further tolerances may arise in the downstream electronics after position value comparison (contact the manufacturer)

<sup>3)</sup> See *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure

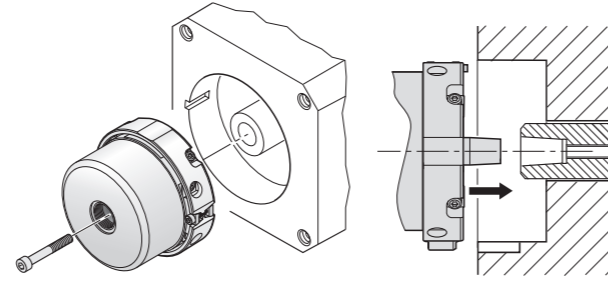
<sup>4)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>5)</sup> Valid as per standard at room temp.; at operating temps. of up to 100 °C: ≤ 300 m/s<sup>2</sup>; up to 115 °C: ≤ 150 m/s<sup>2</sup>

<sup>6)</sup> In collective package upon request

## Mounting

The tapered shaft of the rotary encoder is pressed onto the measured shaft and fastened with a central screw. It is particularly important to ensure that the positive-locking element of the stator coupling securely engages the corresponding slot in the measured shaft. Use a screw with material bonding anti-rotation lock (see Mounting accessories). The stator coupling is clamped by means of an axially tightenable screw in a locating hole.



### More information:

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

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 and can be ordered separately.

ECN 1325, EQN 1337	Screws <sup>1)</sup>		Lot size
Central screw for shaft fastening	DIN 6912-M5x50-8.8-MKL	ID 202264-54	10 or 100

<sup>1)</sup>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 solely to the connector and not to the wires.

ID 1075573-01



### EnDat 3 adapter (SA 1210)

Adapter for connecting an encoder with EnDat 3 (E30-R2) to the PWM 21

ID 1317260-01



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

## Integrated temperature evaluation

This rotary encoder features an internal temperature sensor integrated into the encoder electronics and an evaluation circuit for an external temperature sensor. In both cases, the respective digitized temperature value is transmitted purely serially over the EnDat protocol. Please bear in mind that neither the temperature measurement nor the transmission of the temperature value is safe in terms of functional safety. With regard to the internal temperature sensor (FID 0x21 SENSOR\_TEMP\_INT), the rotary encoder supports the two-stage cascaded signaling of a temperature exceedance. It consists of an EnDat warning and an EnDat error message. In compliance with the EnDat specification, when the temperature reaches the warning threshold for temperature exceedance of the internal temperature sensor, an EnDat warning is issued (HPF.STATUS.W "collective warning bit"). In addition, bit 26 (W10) "Temperature warning threshold exceeded" is set in the LPF with the FID=ERRMSG. This warning threshold for the internal temperature sensor is stored in the parameter SET.tempWarnLevel and can be individually adjusted. A device-specific default value is saved here 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, as shown in the dimension drawing.

The encoder features a further, albeit non-adjustable trigger threshold for the EnDat error message (HPF.STATUS.F "collective error bit"). In addition, bit 8 (A8) "Permissible ambient conditions exceeded" is set in the LPF with the FID=ERRMSG. This trigger threshold may vary depending on the encoder model and is stated 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. Compliance with the operating temperature at measuring point M1 is required for adherence to the encoder's intended and proper use.

# Electrical connection

## Pin layout

16-pin (12+4-pin) PCB connector					
	Power supply / Serial data transfer			Other signals	
	<b>2b</b>	<b>5a</b>	/	/	
	/	/	<b>1a</b>	<b>1b</b>	
	<b>P_SD+</b> <sup>1)</sup>	<b>P_SD-</b> <sup>1)</sup>	<b>T+</b> <sup>2)</sup>	<b>T-</b> <sup>2)</sup>	
	Violet	Yellow	Brown	Green	

<sup>1)</sup> Supply voltage and data: P\_SD+ contains U<sub>P</sub> (power supply); P\_SD- contains 0 V

<sup>2)</sup> Connections for external temperature sensor; evaluation optimized for KTY 84-130, PT 1000, and others; (see *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure)

Vacant pins or wires must not be used!

## 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.



### More information:

Comply with the requirements described in the following documents to ensure correct and intended operation:

- Operating Instructions

1380033-xx

For more information about EnDat 3, visit: [www.endat.de](http://www.endat.de)

For brochures and Product Information documents, visit: [www.heidenhain.com](http://www.heidenhain.com)