HEIDENHAIN

Product Information

ECN 1325
EQN 1337

Absolute Rotary Encoders
with Tapered Shaft for
Safety-Related Applications

For HMC 2 connection
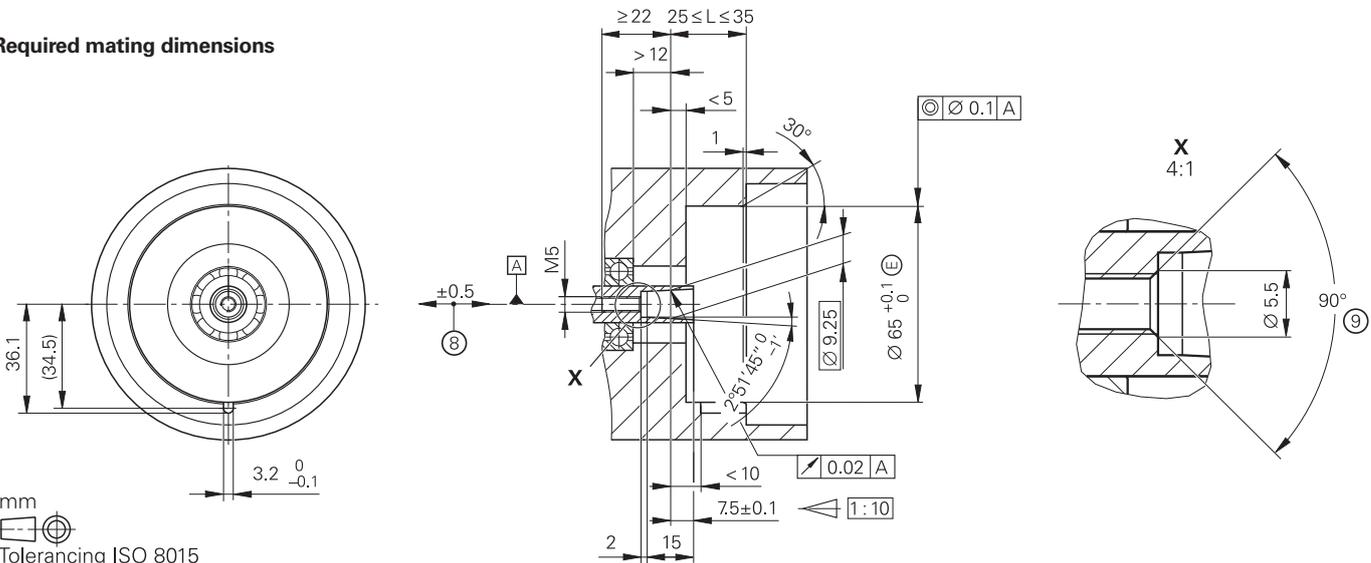technology

Functional
Safety

ECN 1325, EQN 1337

Rotary encoders for absolute position values with safe singleturn information
- **65 mm installation diameter**
- **07B expanding ring coupling**
- **65B tapered shaft**

Functional Safety
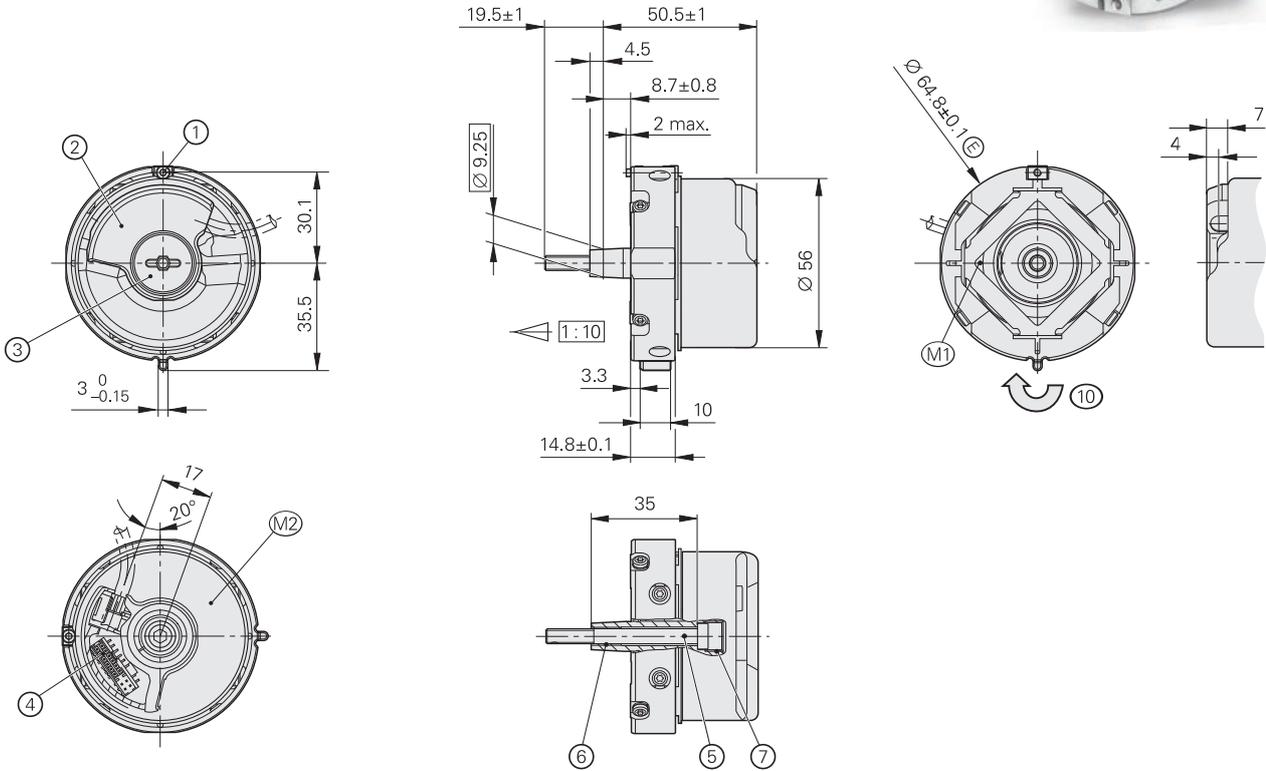
Required mating dimensions

mm

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

[A] = 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, width A/F 3 and A/F 4, tightening torque: 5 Nm +0.5 Nm
4 = 16-pin (12+4-pin) PCB connector
5 = Screw: DIN 6912 – M5x50 – 08.8 – MKL, width A/F 4, tightening torque: 5 Nm +0.5 Nm
6 = M6 back-off thread
7 = M10 back-off thread
8 = Compensation of mounting tolerances and thermal expansion, no dynamic movement permitted
9 = Chamfer at start of thread is obligatory for material bonding anti-rotation lock
10 = Direction of shaft rotation for ascending position values

Specifications	ECN 1325 singleturn	EQN 1337 multiturn
Functional safety 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: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2015 Safe in the singleturn range	
PFH[1]	$\leq 10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[2]	*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/s^2)	
Interface	EnDat 3	
Ordering designation	E30-R2	
Position values per revolution	33 554 432 (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	
Propagation time	0.4 µs (typical)	
System accuracy	±20″	
Electrical connection	16-pin PCB connector (12+4-pin); with separate connection option for external temperature sensor[3]	
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[4] (max.)	*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)
Shaft	65B tapered shaft Ø 9.25 mm; taper 1:10	
Shaft speed	$\leq 15 000$ rpm	$\leq 12 000$ rpm
Starting torque at 20 °C	≤ 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	
Natural freq. of stator coupling	1800 Hz (typical)	
Axial motion of measured shaft	$\leq \pm 0.5$ mm	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 300 m/s^2 [5] (EN 60068-2-6); 10 Hz to 55 Hz, 4.9 mm constant peak to peak ≤ 2000 m/s^2 (EN 60068-2-27)	
Operating temperature	–40 °C to 115 °C	
Trigger threshold of message for temperature exceedance	125 °C (measuring accuracy of internal temperature sensor: ±1 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 from the ingress of fluids must be avoided)	
Mass	≈ 0.25 kg	
Part number	ID 1296522-01/-53[6]	ID 1296523-01/-53[6]

[1] For installation at ≤ 2000 m above sea level
[2] Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[3] See *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure
[4] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
[5] Valid as per standard at room temp.; at operating temps. of up to 100 °C: ≤ 300 m/s^2; up to 115 °C: ≤ 150 m/s^2
[6] In collective package upon request

Mounting

The tapered shaft of the rotary encoder is slid 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. A screw with material bonding anti-rotation lock must be used (see *Mounting accessories*). The stator coupling is clamped by means of an axially tightenable screw in a location hole.
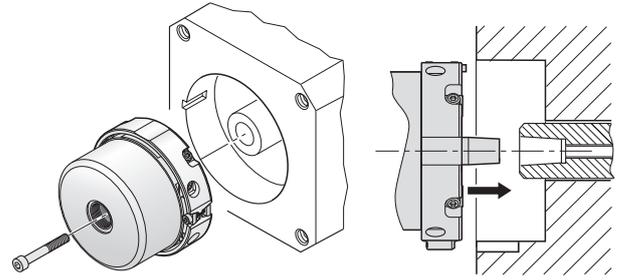
Motor-side requirements for safe mechanical coupling:

Mating shaft	Mating stator
Steel	Aluminum

Rotary encoders may exert a torque of up to 1 Nm on the mating shaft. The customer-side mechanical design must be made for this load.

📖 **Further information:**

In addition, comply with the material specifications and other material characteristics 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 [1]		Quantity
Central screw for shaft fastening	DIN 6912-**M5×50**-8.8-**MKL**	ID 202264-54	10 or 100

[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 *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
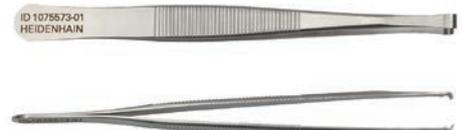
EnDat 3 adapter (SA 1210)
Adapter for connecting an encoder with EnDat 3 (E30-R2) to the PWM 21
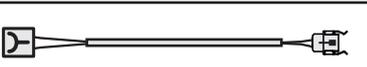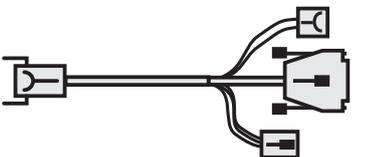
ID 1317260-01

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 a 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 via 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. Fulfillment of the encoder's intended use requires adherence to the operating temperature at measuring point M1.

Electrical connection: cables

ETFE output cable inside the motor housing $\varnothing$ 1.8 mm 2 x 0.15 mm^2, without shield; A_P = 0.15 mm^2		
12-pin PCB connector (female) with strain relief ($\varnothing$ 6.2 mm) and 8-pin M23 SpeedTEC rotatable angle flange socket (male, for communication)		ID 1275042-xx
12-pin PCB connector (female) with strain relief ($\varnothing$ 6.2 mm) and 2 x ETFE twisted single wires (communication)		ID 1302701-xx[1]

ETFE output cable inside the motor housing 2 x 0.15 mm^2 for temperature sensor		
4-pin PCB connector (female) with heat shrink tubing and 2-pin connector (male, for temperature sensor)		ID 1302763-xx

PUR adapter cable $\varnothing$ 11 mm with external shield (testing cable for the PWM 21); 4 × 1.5 mm^2 (power wires) 2 × 0.75 mm^2 (shielded brake wires) 2 × 0.25 mm^2 (shielded communication wires); A_P = 0.25 mm^2		
8-pin M23 SpeedTEC straight connector (female) and 3-pin connector (female, for power) and 4-pin connector (male, for brake wires) and 15-pin D-sub connector (male, for communication)		ID 1275291-xx

[1] Connecting element must be suitable for the maximum data rate used
Please comply our *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

Electrical connection: pin layout

	HMC 2 8-pin M23 SpeedTEC angle flange socket ▭ M23		16-pin PCB connector (12+4-pin) ▭ 12 ▭ 4			

	Encoder			
	Power supply / Serial data transfer		Other signals	
▭ **M23**	**A**	**B**	/	/
▭ **12**	**2b**	**5a**	/	/
▭ **4**	/	/	**1a**	**1b**
▭ **2**	/	/	**2**	**1**
	P_SD+[1]	**P_SD–**[1]	**T+**[2]	**T–**[2]
▭	Violet	Yellow	Brown	Green

	Motor					
	Brake		Power			
▭ **M23**	**C**	**D**	**1**	**4**	**3**	**2**
	Brake +	**Brake –**	**U**	**V**	**W**	**PE**

[1] Power supply and data: P_SD+ contains U_P (power supply); P_SD– contains 0 V
[2] Connections for external temperature sensor; evaluation optimized for a KTY 84-130, PT 1000, and other sensors;
(see *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure)

Vacant pins or wires must not be used!

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

📖 **Further information:**

Comply with the requirements described in the following documents to ensure correct and intended operation:
- Brochure: *Encoders for Servo Drives* — 208922-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* — 1078628-xx
- Brochure: *Cables and Connectors* — 1206103-xx
- Product information doc.: *HMC 2* — 1305512-xx
- Technical information doc.: *EnDat 3* — 1305415-xx
- Mounting instructions: *ECN 1325, EQN 1337* — 1327998-xx
- EnDat 3 Application Conditions for Functional Safety — 3000003-xx

For more information on EnDat 3, visit: *www.endat.de*
For brochures and Product Information documents, visit: *www.heidenhain.de*