HEIDENHAIN

Functional Safety

Product Information

ECI 1119
EQI 1131

Absolute Rotary Encoders without Integral Bearing

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

EnDat 3

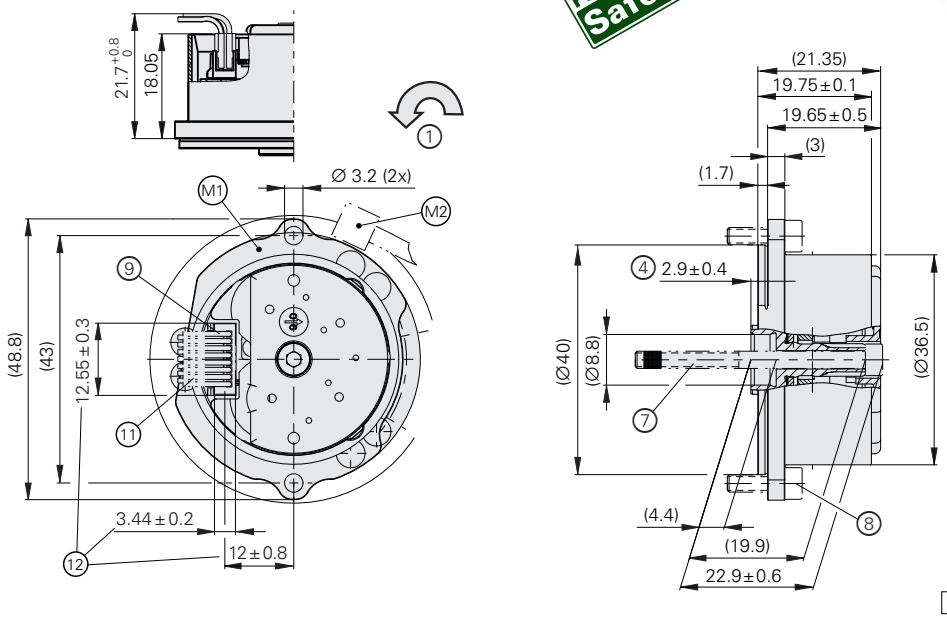
70H flange (82D shaft)

For HMC 2 connection technology

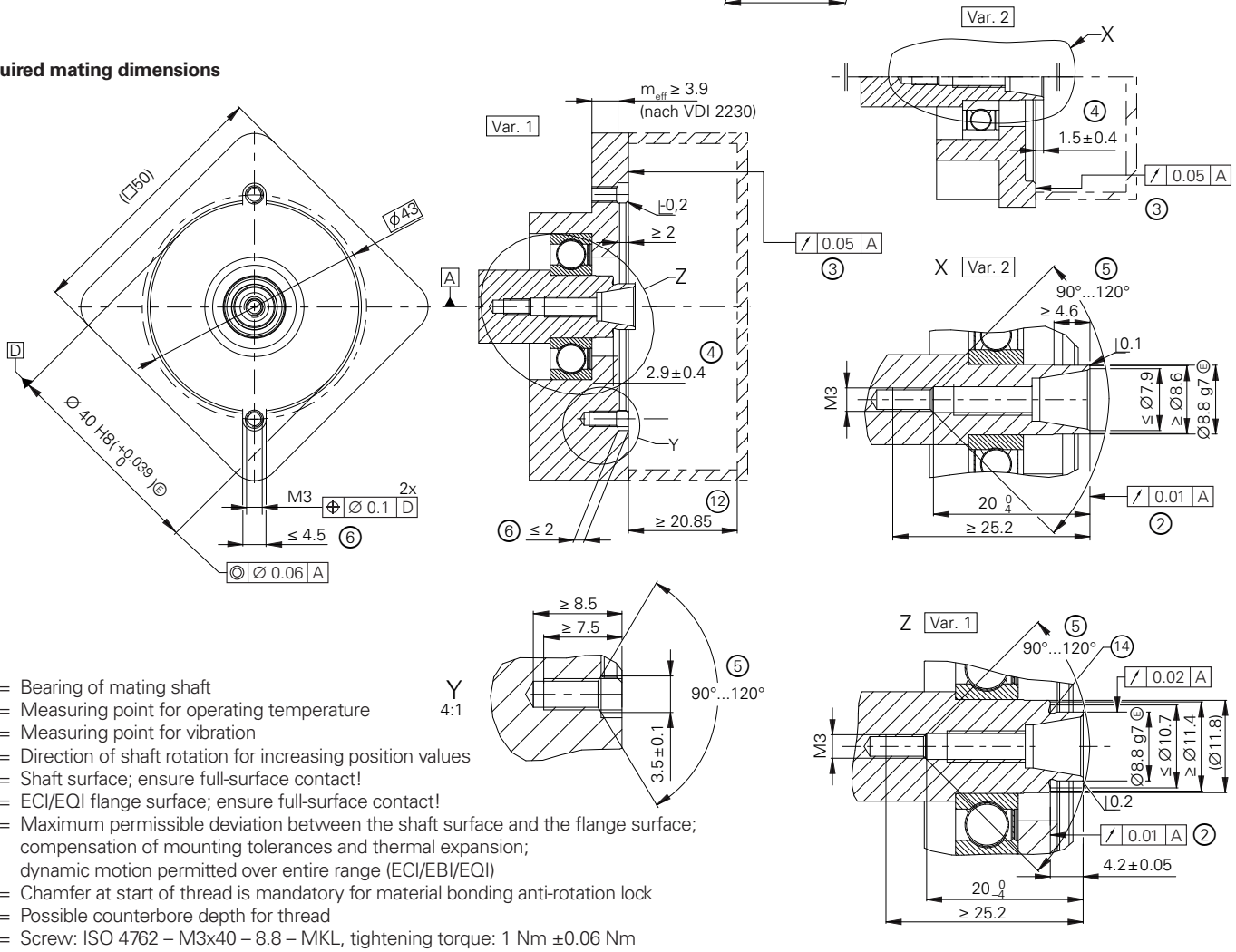
05/2023

ECI 1119, EQI 1131

Rotary encoders for absolute position values with safe singleturn information
- **Robust inductive scanning principle**
- **82D blind hollow shaft (Ø 8.8 mm) for axial clamping**



Required mating dimensions



A = Bearing of mating shaft
M1 = Measuring point for operating temperature
M2 = Measuring point for vibration
1 = Direction of shaft rotation for increasing position values
2 = Shaft surface; ensure full-surface contact!
3 = ECI/EQI flange surface; ensure full-surface contact!
4 = Maximum permissible deviation between the shaft surface and the flange surface; compensation of mounting tolerances and thermal expansion; dynamic motion permitted over entire range (ECI/EBI/EQI)
5 = Chamfer at start of thread is mandatory for material bonding anti-rotation lock
6 = Possible counterbore depth for thread
7 = Screw: ISO 4762 – M3x40 – 8.8 – MKL, tightening torque: 1 Nm ±0.06 Nm
8 = Screw: ISO 4762 – M3x10 – 8.8 – MKL, tightening torque: 1 Nm ±0.06 Nm
9 = 15-pin header
10 = Dimension for JH standard cable
11 = Ensure space for cable
12 = Distance to the cover; note the opening for the plug connector, socket connector and wires
13 = Uncoated; no coating permitted
14 = Undercut shape G

mm
Tolerancing ISO 8015
ISO 2768:1989-mH
≤ 6 mm: ±0.2 mm

Specifications	ECI 1119 singleturn	EQI 1131 multiturn
Functional safety for applications with up to	As a single-encoder system for monitoring and control-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 With additional measures as per Document 1277016, suitable for safety-related applications with up to SIL 3 or Category 4, PL e Safe in the singleturn range	
PFH[1]	*SIL 2:* ≤ $15 \cdot 10^{-9}$ (probability of dangerous failure per hour) *SIL 3:* ≤ $2 \cdot 10^{-9}$	
Safe position[2]	*Encoder:* ±1.06° (safety-related measuring step SM = 0.35°) *Mechanical coupling for 82D shaft:* ±0°, designed for accelerations at the stator: ≤ 400 m/s²; at the rotor: ≤ 600 m/s²)	
Interface	EnDat 3	
Ordering designation	E30–R2	
Position values per rev.	524 288 (19 bits)	
Revolutions	–	4096 (12 bits)
XEL.time HPFout data rate	≤ 11 µs at 12.5 Mbit/s ≤ 8.2 µs at 25 Mbit/s	
System accuracy	±120″	
Electrical connection	15-pin PCB connector (with connection 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	
Current consumption (typical)	*At 12 V:* 45 mA (without communication)	*At 12 V:* 50 mA (without communication)
Power consumption[4] (maximum)	*At 4 V:* ≤ 850 mW; *at 14 V:* ≤ 900 mW	*At 4 V:* ≤ 950 mW; *at 14 V:* ≤ 1000 mW
Shaft	82D blind hollow shaft (Ø 8.8 mm) for axial clamping	
Shaft speed	≤ 15 000 rpm	≤ 12 000 rpm
Moment of inertia of rotor	$0.23 \cdot 10^{-6}$ kgm²	
Angular acceleration of rotor	≤ $1 \cdot 10^{5}$ rad/s²	
Axial motion of measured shaft	≤ ±0.4 mm	
Vibration 55 Hz to 2000 Hz[5] **Shock** 6 ms	*Stator:* ≤ 400 m/s²; *rotor:* ≤ 600 m/s² (EN 60068-2-6) ≤ 2000 m/s² (EN 60068-2-27)	
Operating temperature	–40 °C to 110 °C	
Trigger threshold of error message for excessive temperature	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	IP00	
Mass	≈ 0.04 kg	
ID number	1259551-05/-55[6]	1259552-05/-55[6]

[1] For use at ≤ 2000 m above sea level
[2] Further tolerances may arise in the downstream electronics after position value comparison (contact mfr. of the downstream 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 or at *www.heidenhain.com*
[5] 10 Hz to 55 Hz, 4.9 mm constant peak to peak
[6] Rotary encoders in a collective package

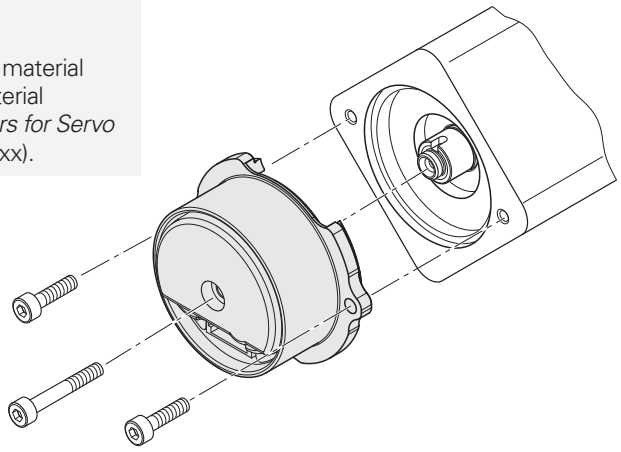
Mounting

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

More information:

For the customer-side mounting design, aluminum and steel are permissible materials for the customer-side shaft and stator.

In addition, comply with the material specifications and other material characteristics in the *Encoders for Servo Drives* brochure (ID 208922-xx).



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

Mounting accessories

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

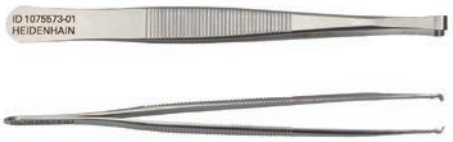
ECI 1119 / EQI 1131	Screws[1)]
Central screw for shaft fastening	ISO 4762-**M3×40**-8.8-**MKL**
Fastening screw for flange	ISO 4762-**M3×10**-8.8-**MKL**

[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. Apply pulling force only to the connector of the cable assembly and not to the wires.

ID 1075573-01



Mounting aid
For turning the encoder shaft from the rear. This facilitates finding the positive-locking connection between the encoder and the measured shaft.

ID 821017-03

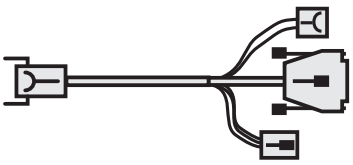
EnDat 3 adapter
Adapter for connecting an encoder with EnDat 3 (E30-R2) to the PWM 21

ID 1317260-01

For further mounting information and mounting aids, please refer to the relevant mounting instructions and the *Encoders for Servo Drives* brochure. The mounting arrangement can be checked with the PWM 21 and ATS software.
For selection of the software, please contact HEIDENHAIN.

Electrical connection

Cable

PUR adapter cable ∅ 9.3 mm with external shield; 4 x 0.5 mm^2 (power wires) 2 x 0.34 mm^2 (brake wires, shielded) 2 × 0.14 mm^2 (communication wires, shielded); A_P = 0.14 mm^2		
8-pin M12 SpeedTEC straight connector (female), 3-pin header connector (power), and 4-pin header (brake wires), and 15-pin D-sub connector (male) (communication)		1279881-xx

The connecting element must be suitable for the maximum clock frequency used.
Note for safety-related applications:
- Conformity with the EMC Directive must be ensured in the complete system!

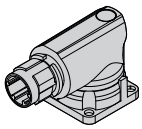
SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

More information:
For connecting cables and adapter cables, see the *Cables and Connectors* brochure (ID 1206103-xx).

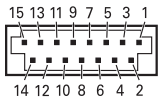
Pin layout of ECI, EQI

8-pin M12 SpeedTEC angle flange socket

8

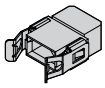


15-pin PCB connector



15

2



	Encoder			
	Power supply / Serial data transfer		Other signals	
8	**A**	**B**	**/**	**/**
15	**9**	**10**	**5**	**6**
2	**–**	**–**	**2**	**1**
	P_SD+[1]	**P_SD–**[1]	**T+**[2]	**T–**[2]
	Violet	Yellow	Brown	Green

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

[1] Power supply and data: P_SD+ includes U_P; P_SD– includes 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)

Cable shield connected to housing; **U_P** = Power supply voltage
Vacant pins or wires must not be used!
Note on safety-related applications: Only completely assembled HEIDENHAIN cables are qualified for this.
Do not modify cables or exchange their connectors without first consulting with HEIDENHAIN Traunreut!

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH
Dr.-Johannes-Heidenhain-Straße 5
83301 Traunreut, Germany
☏ +49 8669 31-0
FAX +49 8669 32-5061
info@heidenhain.de

www.heidenhain.com

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: *ECI 1119, EQI 1131 Functional Safety* 1388665-xx
- Product Information document: *HMC 2* 1305512-xx
- Technical Information document: *EnDat 3* 1305415-xx
- EnDat 3 Application Conditions for Functional Safety 3000003-xx
- Supplementary Application Conditions for EnDat 3 for Step Monitoring (SIL 3, PL e) 1277016-xx

1388667 · 00 · A · 02 · 05/2023 · PDF