HEIDENHAIN

ECI 1319 S
EQI 1331 S

Absolute Rotary Encoders without Integral Bearing and with DRIVE-CLiQ Interface

Firmware 15

Functional Safety

ECI 1319 S, EQI 1331 S

**Rotary encoders for absolute position values with safe singleturn information**
- **Robust inductive scanning principle**
- **Mounting-compatible with photoelectric rotary encoders with 07B stator coupling**
- **0YA mounting flange**
- **Blind hollow shaft for axial clamping Ø 12.7 mm (44C) or Ø 12 mm (44A)**
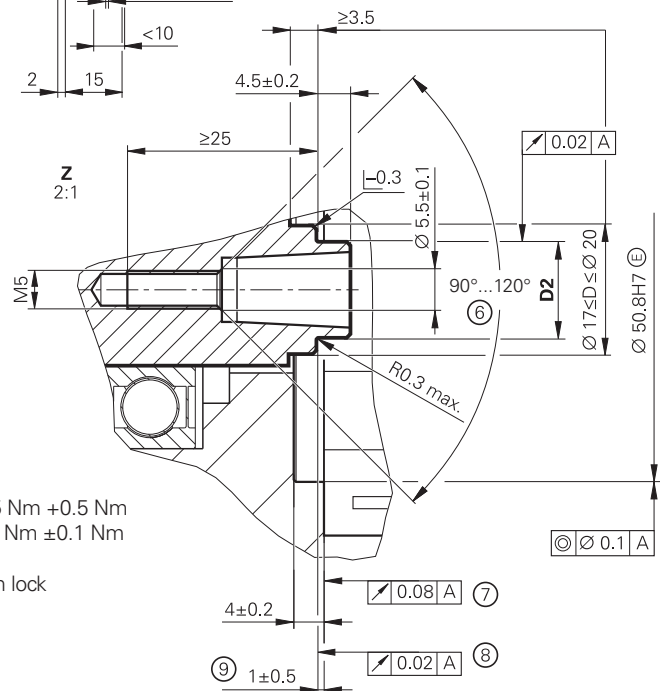- **Cost-optimized mating dimensions upon request**

Functional Safety
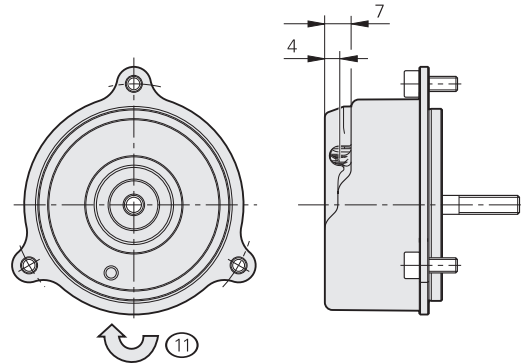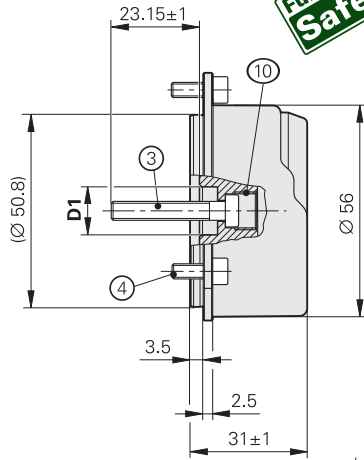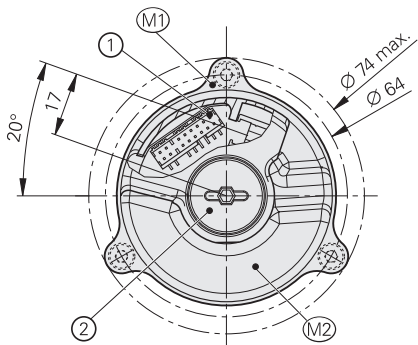
Required mating dimensions
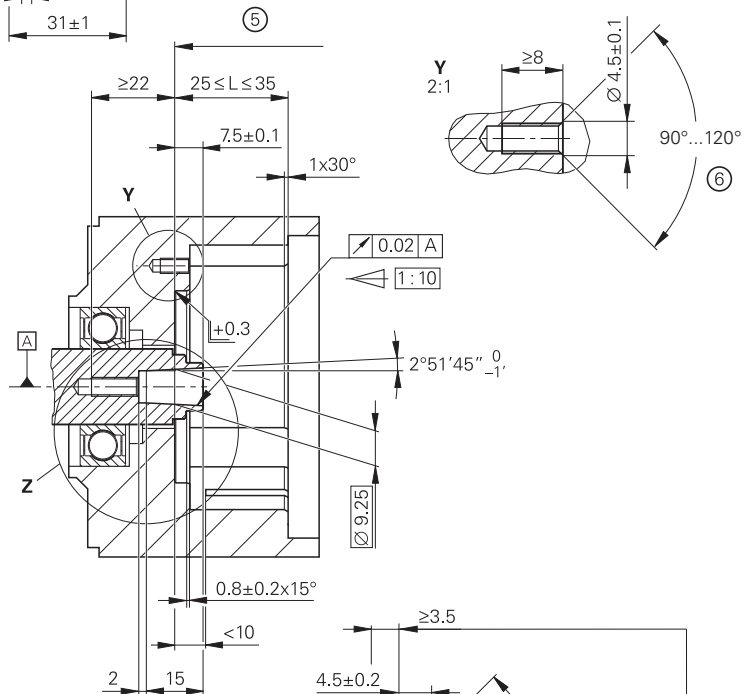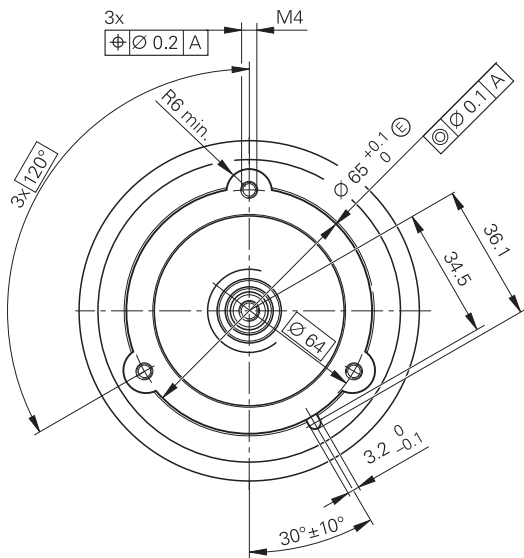
D1	D2
Ø 12G6 Ⓔ	Ø 12h6 Ⓔ
Ø 12.7G6 Ⓔ	Ø 12.7h6 Ⓔ

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

Ⓐ = Bearing of mating shaft
M1 = Measuring point for operating temperature
M2 = Measuring point for vibration; see also D 741714
1 = 12-pin + 4-pin header
2 = Screw plug: widths A/F 3 and 4; tightening torque: 5 Nm +0.5 Nm
3 = Screw: DIN 6912 – M5x30 – 8.8 – MKL; width A/F 4; tightening torque: 5 Nm +0.5 Nm
4 = Screw: ISO 4762 – M4x10 – 8.8 – MKL; width A/F 3; tightening torque: 2 Nm ±0.1 Nm
5 = Functional diameter of taper for ECN/EQN 13xx
6 = Chamfer at start of thread is obligatory for materially bonding anti-rotation lock
7 = Flange surface Exl/resolver; ensure full-surface contact!
8 = Shaft; ensure full-surface contact!
9 = Mounting clearance between shaft and flange surfaces;
     compensation of mounting tolerances and thermal expansion;
     ECI/EQI: dynamic motion permitted over entire range;
     ECN/EQN: no dynamic motion permitted
10 = M10 back-off thread
11 = Direction of shaft rotation for ascending position values

Specifications	ECI 1319 S: singleturn	EQI 1331 S: multiturn
Functional safety for applications up to	As single-encoder system for monitoring 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]	*SIL 2:* $\leq 27 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[2]	*Encoder:* $\pm 0.88°$ (safety-related measuring step SM = 0.35°) *Mechanical coupling:* 0° (fault exclusion for the loosening of the shaft coupling and stator coupling; designed for accelerations at the stator of ≤ 400 m/s^2; at the rotor: ≤ 600 m/s^2)	
Interface	DRIVE-CLiQ	
Ordering designation	DQ01	
Position values per revolution	524 288 (19 bits)	
Firmware	01.32.27.15	
Siemens software[3]	SINAMICS, SIMOTION: ≥ 4.6 HF3 SINUMERIK with safety: ≥ 4.7 SP1 HF1; SINUMERIK without safety: ≥ 4.5 SP2 HF4	
Revolutions	–	4096 (12 bits)
TIME_MAX_ACTVAL[4]	≤ 12 µs	
System accuracy	$\pm 65''$	
Electrical connection	*Encoder PCB connector:* 16-pin; with connection for temperature sensor[5]	
Cable length	≤ 40 m (see description in the *Interfaces of HEIDENHAIN Encoders* brochure)	
Supply voltage	DC 24 V (10 V to 28.8 V; up to DC 36.0 V possible without impairing the functional safety)	
Power consumption[6] (maximum)	*At 10 V:* ≤ 1100 mW *At 28.8 V:* ≤ 1250 mW	*At 10 V:* ≤ 1200 mW *At 28.8 V:* ≤ 1350 mW
Current consumption (typical)	*At 24 V:* 40 mA (without load)	*At 24 V:* 45 mA (without load)
Shaft	Blind hollow shaft for axial fastening $\varnothing$ 12.7 mm (44C) or $\varnothing$ 12 mm (44A)	
Spindle speed	$\leq 15 000$ rpm	$\leq 12 000$ rpm
Moment of inertia of rotor	$2.45 \cdot 10^{-6}$ kgm^2	$2.6 \cdot 10^{-6}$ kgm^2
Angular acceleration of rotor	$\leq 1 \cdot 10^5$ rad/s^2	
Axial motion of measured shaft	$\leq \pm 0.5$ mm	

[1] For use at an altitude of ≤ 1000 m above sea level
[2] Further tolerances may arise in subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
[3] Information from Siemens as per the document "Certified encoders with DRIVE-CLiQ Dependencies on SIMOTION / SINUMERIK and SINAMICS Hardware and Software versions" (version: 04/2019)
[4] The calculation time TIME_MAX_ACTVAL specifies the time after which a data transfer from the encoder to the control can start within the current-regulator clock time
[5] See *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure
[6] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure or at *www.heidenhain.de*

DRIVE-CLiQ is a registered trademark of Siemens AG

Specifications	ECI 1319 S: singleturn	EQI 1331 S: multiturn
Vibration 55 Hz to 2000 Hz[7] **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 100 °C	
Trigger threshold for temperature exceedance error message	120 °C (measuring accuracy of the internal temperature sensor: ±1 K)	
Relative humidity	≤ 93 % (40 °C/21 d as per EN 60068-2-78); condensation excluded	
Protection EN 60529	IP20 (read about insulation under *General electrical information* in the *Encoders for Servo Drives* brochure)	
Mass	≈ 0.13 kg	
ID number*	ID 1222049-01 (shaft 44C) ID 1222049-02 (shaft 44A)	ID 1222051-01 (shaft 44C) ID 1222051-02 (shaft 44A) ID 1222051-51 (shaft 44C)[8]

* Please select when ordering; 44A shaft upon request
[7] 10 Hz to 55 Hz, 4.9 mm constant peak to peak
[8] In collective package

Mounting

The blind hollow shaft of the rotary encoder is slid 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*).

The following conditions must be complied with for the customer-side mounting design:

	Mating stator	Mating shaft
Material	Aluminum	Steel
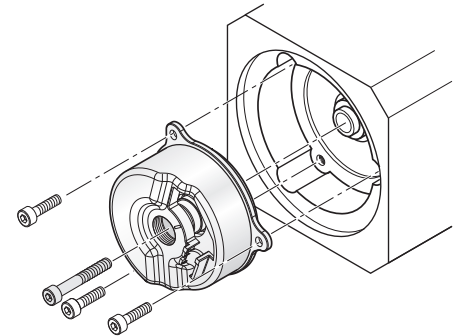
📖 **Further information:**

Also pay attention to 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 1319 S EQN 1331 S	Screws[1]		Quantity
Central screw for shaft fastening	ISO 6912-**M5×30**-08.8-**MKL**	ID 202264-76	10 or 100
Mounting screw for flange	ISO 4762-**M4×10**-8.8-**MKL**	ID 202264-85	30 or 300

[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. The pulling force must be applied only to the connector and not to the wires.

ID 1075573-01

For further mounting information and mounting aids, please refer to the relevant mounting instructions and the *Encoders for Servo Drives* brochure. The mounting quality can be checked with the PWM 21 and the 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. The digitized temperature value of the external temperature sensor can be transferred purely serially over the DRIVE-CLiQ interface. Please bear in mind that neither the temperature measurement nor the transmission of the temperature value is safe in terms of functional safety.

The temperature measured by the internal temperature sensor is higher by a device-specific and application-specific amount than the temperature at the measuring point M1 in accordance with the dimension drawing. Upon reaching a trigger threshold for the internal temperature, the rotary encoder outputs an "Alarm 135" error message. This threshold may vary depending on the encoder and is stated in the specifications. During operation, it is recommended that the temperature be kept adequately below this threshold.

Compliance with the operating temperature at measuring point M1 is required for adherence to the encoder's proper and intended use.

Temperature measurement in motors

To protect a motor from overloading, the motor manufacturer usually installs a temperature sensor in close proximity to the motor winding.

For this purpose, a PT 1000 or, for example, a KTY 84-130 semiconductor sensor is to be used. For a PT 1000, the following values apply with regard to the accuracy of the evaluation circuit:

±6 K at -40 °C to 80 °C
±4 K at 80.1 °C to 160 °C
±6 K at 160.1 °C to 200 °C

For a KTY 84-130 semiconductor sensor, the following values apply with regard to the accuracy of the evaluation circuit:

±6 K at -40 °C to 80 °C
±2 K at 80.1 °C to 160 °C
±6 K at 160.1 °C to 200 °C

The temperature values are transmitted via the DRIVE-CLiQ protocol.

The temperature sensor used is adjustable via parameter 601 in the configuration software (e.g., starter) of the drive.

Electrical connection

Cables

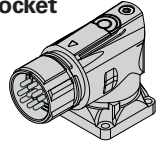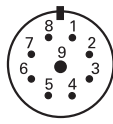| **EPG encoder cable inside the motor** $\varnothing$ 3.7 mm; $2 \times (2 \times 0.06 \text{ mm}^2) + 4 \times 0.06 \text{ mm}^2$; $A_P = 0.06 \text{ mm}^2$ with shield crimping $\varnothing$ 6.1 mm and wires for temperature sensor[1] TPE $2 \times 0.16 \text{ mm}^2$		
16-pin PCB connector and 9-pin M23 SpeedTEC angle flange socket (male) with wires for temperature sensor		ID 1120945-xx

[1] Electromagnetic compatibility must be ensured in the complete system.

PUR adapter cable $\varnothing$ 6.8 mm; $2 \times (2 \times 0.17 \text{ mm}^2) + 2 \times 0.24 \text{ mm}^2$; $A_P = 0.24 \text{ mm}^2$		
9-pin M23 SpeedTEC* connector (female) and 8+2-pin RJ45 connector (IP20)		ID 1121546-xx
9-pin M23 SpeedTEC connector (female) and 8-pin M12 coupling (male)		ID 1121536-xx

A_P: Cross section of power supply lines
* SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH

Pin layout

9-pin M23 right-angle socket	16-pin PCB connector

	Voltage supply		Serial data transmission				Other signals[1]	
M23	8	4	5	6	1	2	/	/
16	3a	4b	6b	1a	2b	5a	8a	8b
	U_P	0 V	RXP	RXN	TXP	TXN	T+[2]	T–[2]
	White	White/Green	Gray	Pink	Violet	Yellow	Brown	Green

[1] Only for adapter cables inside the motor housing
[2] Connections for external temperature sensor; regarding evaluation, refer to *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 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.

📖 **Further information:**

Comply with the requirements described in the following documents to ensure the correct and intended operation of the encoder:
- Brochure: *Encoders for Servo Drives* — 208922-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* — 1078628-xx
- Brochure: *Cables and Connectors* — 1206103-xx
- Mounting instructions: *ECI 1319 S, EQI 1331 S* — 1000453-xx
- Technical Information document: *Safety-Related Position Measuring Systems* — 596632