HEIDENHAIN

Product Information

ECI 1319S
EQI 1331S

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

Firmware 15

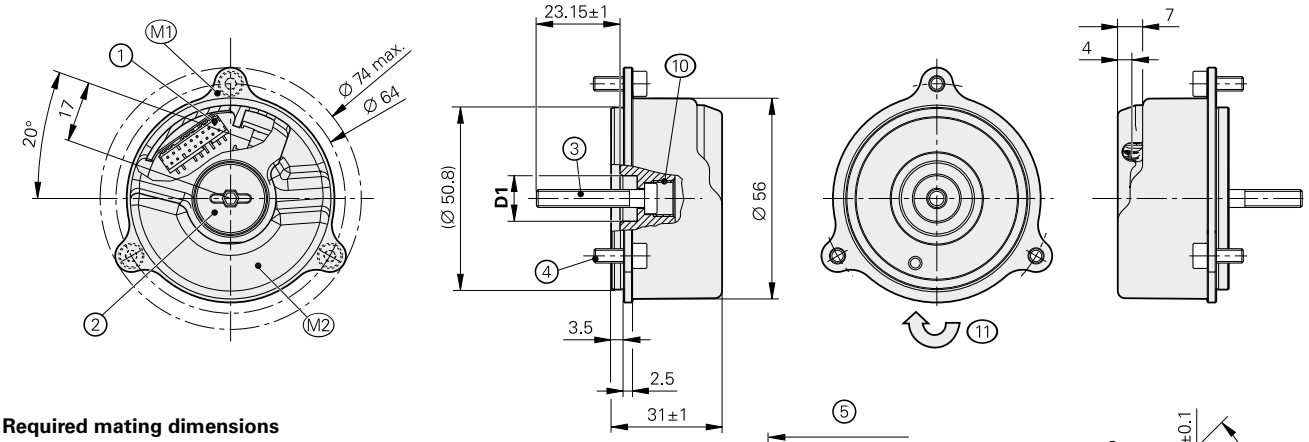
09/2019

ECI 1319S, EQI 1331S

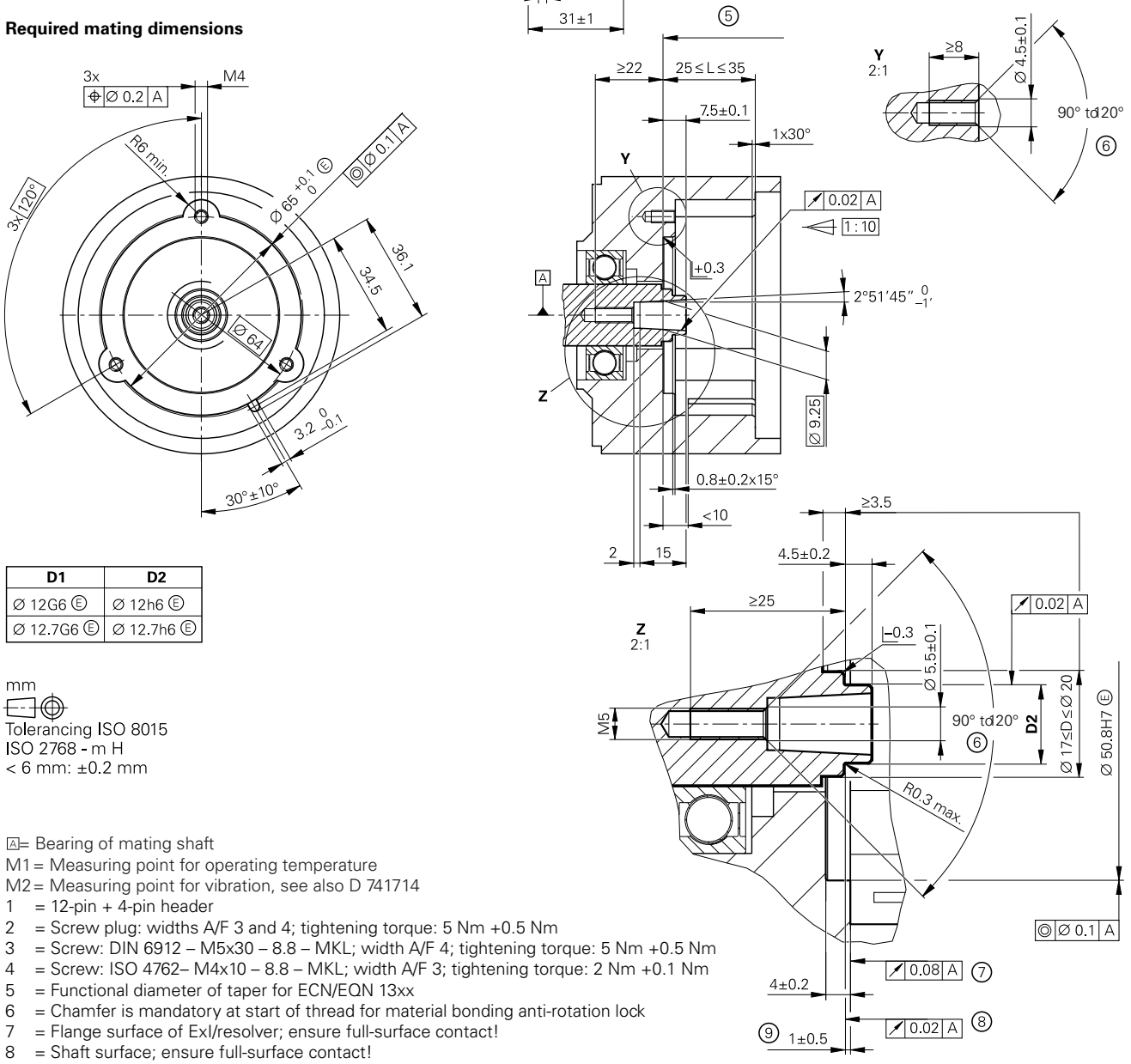
Rotary encoders for absolute position values with safe singleturn information

- **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 E	Ø 12h6 E
Ø 12.7G6 E	Ø 12.7h6 E

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 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 is mandatory at start of thread for material bonding anti-rotation lock
7 = Flange surface of ExI/resolver; ensure full-surface contact!
8 = Shaft surface; ensure full-surface contact!
9 = Maximum permissible deviation between shaft surface and flange surface; 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 1319S – Singleturn	EQI 1331S – 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	*SIL 2:* ≤ $27 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position [1]	*Encoder:* ± 0.88° (safety-related measuring step SM = 0.35°); *mechanical coupling:* 0° (fault exclusion for loosening of the shaft coupling and stator coupling; designed for accelerations on the stator: ≤ 400 m/s²; on the rotor: ≤ 600 m/s²)	
Interface	DRIVE-CLiQ	
Ordering designation	DQ01	
Position values per revolution	524 288 (19 bits)	
Firmware	01.32.27.15	
SINAMICS, SIMOTION [2]	≥ 4.6 HF3	
SINUMERIK with safety [2]	≥ 4.7 SP1 HF1	
SINUMERIK without safety [2]	≥ 4.5 SP2 HF4	
Revolutions	-	4096 (12 bits)
TIME_MAX_ACTVAL [3]	≤ 12 µs	
System accuracy	±65"	
Electrical connection	PCB connector on rotary encoder: 16-pin, with connection for temperature sensor [4]	
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 [5] (max.)	*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 clamping Ø 12.7 mm (44C) or Ø 12 mm (44A)	
Shaft speed	≤ 15 000 rpm	≤ 12 000 rpm
Moment of inertia of rotor	$2.45 \cdot 10^{-6}$ kgm²	$2.6 \cdot 10^{-6}$ kgm²
Angular acceleration of rotor	≤ $1 \cdot 10^{5}$ rad/s²	
Axial motion of measured shaft	≤ ±0.5 mm	

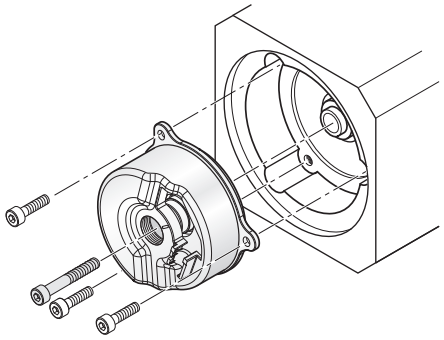
1) Further tolerances may arise in the subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
2) Information from Siemens as per document "Certified encoders with DRIVE-CLiQ Dependencies on SIMOTION / SINUMERIK and SINAMICS Hardware and Software versions" (version: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

Specifications	ECI 1319S – Singleturn	EQI 1331S – Multiturn
Vibration 55 Hz to 2000 Hz [1] **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 100 °C	
Trigger threshold of error message for temperature exceedance	120 °C (measuring accuracy of the internal temperature sensor: ±1 K)	
Relative humidity	≤ 93 % (40 °C/21 d as per EN 60068-2-78); without condensation	
Protection class EN 60529	IP20 (read about isolation under *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochures)	
Mass	≈ 0.13 kg	
ID number*	ID 1222049-01 (44C shaft) ID 1222049-02 (44A shaft)	ID 1222051-01 (44C shaft) ID 1222051-02 (44A shaft) ID 1222051-51 (44C shaft) [2]

* Please select when ordering; 44A shaft upon request
1) 10 Hz to 55 Hz, 4.9 mm constant peak to peak
2) 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 material properties and conditions must be complied with for the customer-side mounting design:

	Mating stator	**Mating shaft**
Material	Aluminum	Steel
Tensile strength R_m	≥ 220 N/mm^2	≥ 600 N/mm^2
Yield strength $R_{p0.2}$ or yield point R_e	-	≥ 400 N/mm^2
Shear strength τ_a	130 N/mm^2	≥ 390 N/mm^2
Interface pressure P_G	≥ 250 N/mm^2	≥ 660 N/mm^2
Modulus of elasticity E (at 20 °C)	70 kN/mm^2 to 75 kN/mm^2	200 kN/mm^2 to 215 kN/mm^2
Coefficient of thermal expansion α_{therm} (at 20 °C)	≤ 25 · 10^{-6} K^{-1}	10 · 10^{-6} K^{-1} to 17 · 10^{-6} K^{-1}
Surface roughness R_Z	≤ 16 µm	
Friction values	Mounting surfaces must be clean and free of grease. Use screws from HEIDENHAIN in their delivery condition.	
Tightening procedure	Use a signal-emitting torque wrench as per DIN EN ISO 6789, with an accuracy of ±6 %	
Mounting temperature	15 °C to 35 °C	

Mounting accessories

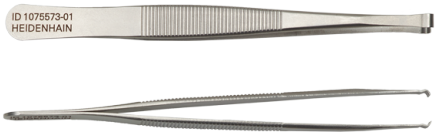
Screws
Screws (central screw, mounting screws) are not included in delivery and can be ordered separately.

ECI 1319S **EQI 1331S**	**Screws** [1]		**Quantity**
Central screw for shaft fastening	DIN 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 of the cable assembly 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 tested with the PWM 21 and the ATS software.

Integrated temperature evaluation

These rotary encoders feature an internal temperature sensor integrated into the encoder electronics, as well as 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-QLiQ 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 measuring point M1 in accordance with the dimension drawing. Upon reaching a trigger threshold for the internal temperature, these rotary encoders output 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 intended and proper 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. In the case of a PT 1000, the following values for the accuracy of the evaluation circuit apply:

±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 for the accuracy of the evaluation circuit apply:

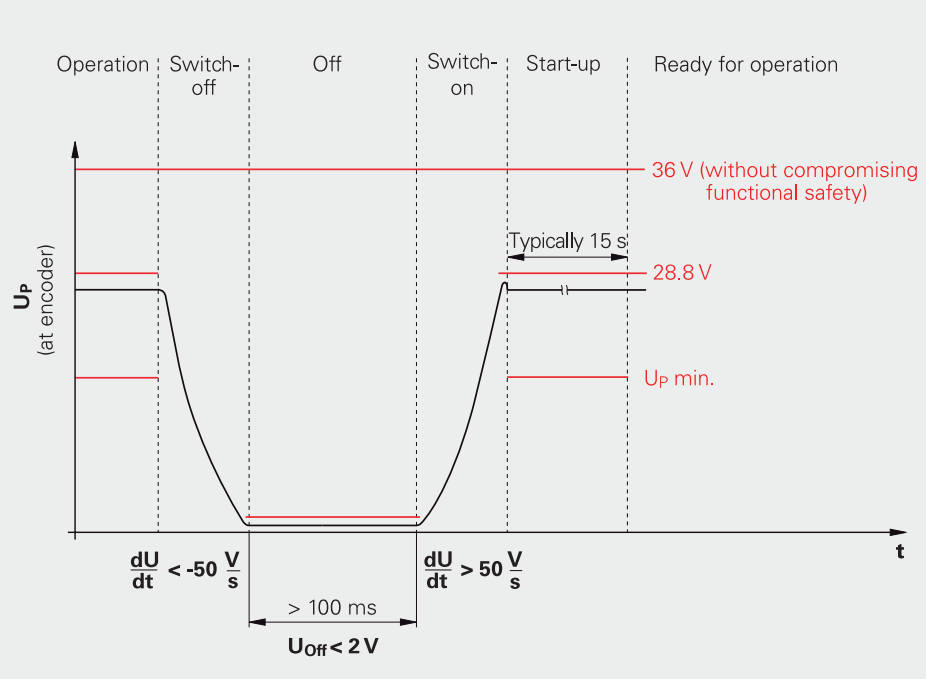
±6 K at –40 °C to 80 °C
±2 K at 80.1 °C to 160 °C
±6 K at 160.1 °C to 200 °C

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

The temperature sensor being used can be configured with parameter 601 in the configuration software of the drive (e.g., Starter software).

Electrical requirements

Switch-on and switch-off conditions



Electrical connection

Cables

EPG output cable inside the motor housing Ø 3.7 mm; 2 × (2 × 0.06 mm²) + 4 × 0.06 mm²; A_P = 0.06 mm² with Ø 6.1 mm shield crimp Ø 6.1 mm and wires for temperature sensor[1] TPE 2 × 0.16 mm²		
With 16-pin PCB connector and 9-pin M23 SpeedTEC* angle flange socket (male) with wires for temperature sensor		ID 1120945-xx

1) The electromagnetic compatibility of the complete system must be ensured.

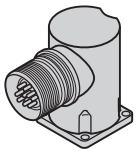
PUR adapter cables Ø 6.8 mm; 2 × (2 × 0.17 mm²) + 2 × 0.24 mm²; A_P = 0.24 mm²		
With 9-pin M23 SpeedTEC* connector (female) and 8+2-pin RJ45 connector (IP20)		ID 1121546-xx
With 9-pin M23 SpeedTEC* connector (female) and 8-pin M12 coupling (male)		ID 1121536-xx

A_P: Cross section of power supply lines

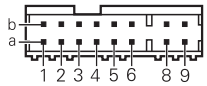
* SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

Pin layout

9-pin M23 right-angle socket



16-pin PCB connector



	Power 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	**0V**	**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; **Up** = Power supply voltage
Vacant pins and 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!

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 made.

Further information: Comply with the requirements described in the following documents to ensure correct 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 1319S, EQI 1331S* 1000453-xx
- Technical Information doc.: *Safety-Related Position Measuring Systems* 596632-xx