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HEIDENHAIN



Product Information

ECI 4090S

Absolute Rotary Encoder
with 180 mm Hollow Shaft
and DRIVE-CLiQ Interface for
Safety-Related Applications

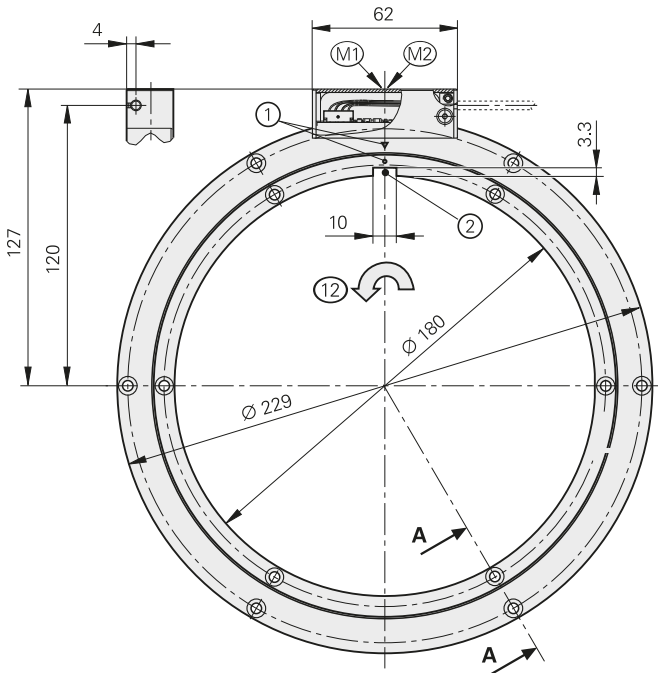


July 2017

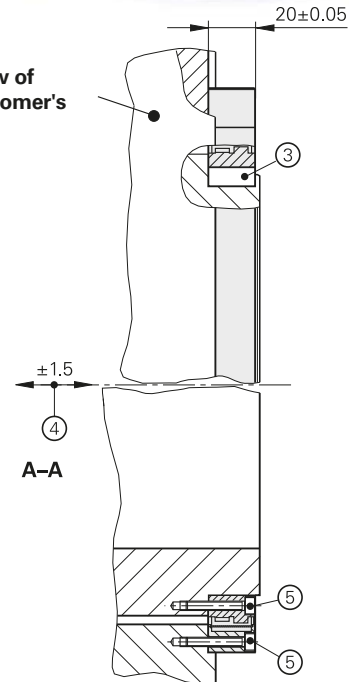
ECI 4090S

Rotary encoders for absolute position values with safe singleturn information

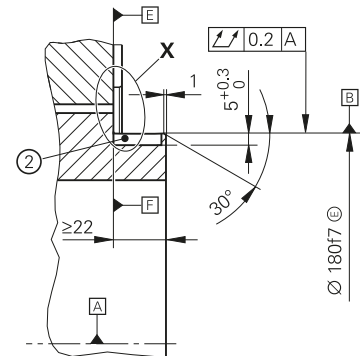
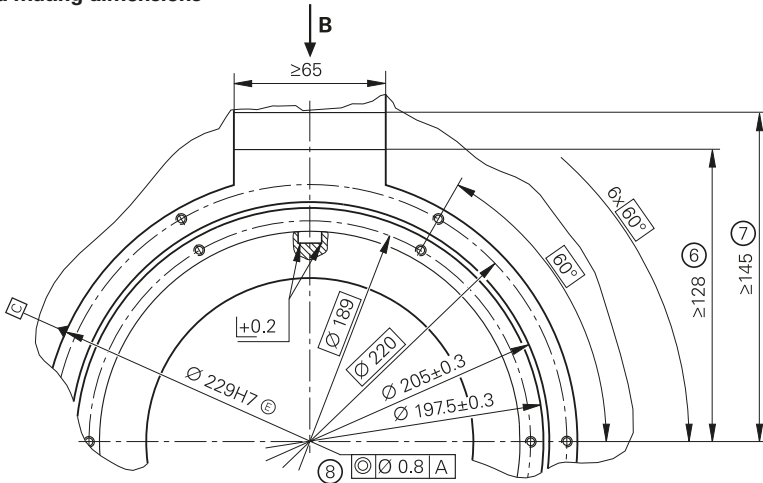
- Rugged inductive scanning principle
- Hollow through shaft $\varnothing 180$ mm
- Consists of scanning unit and scale drum



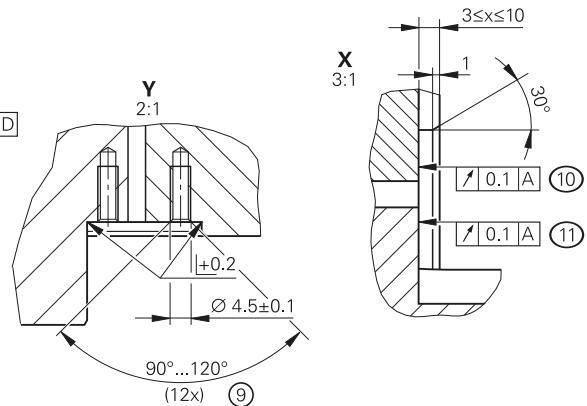
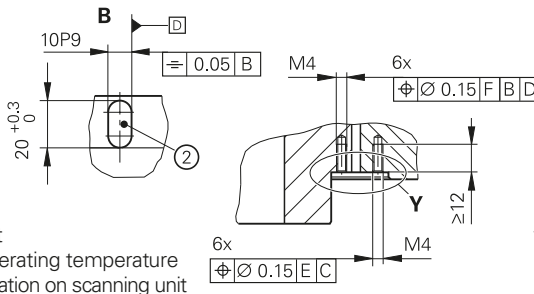
View of customer's side



Required mating dimensions



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 on scanning unit
- ① = Mark for 0° position $\pm 5^\circ$
- ② = Slot for machine key DIN 6885-A-10x8x20
- ③ = Machine key as per DIN 6885-A-10x8x20
- ④ = Maximum permissible axial deviation between shaft and flange surfaces. Compensation of mounting tolerances and thermal expansion. Dynamic motion permitted over entire range.
- ⑤ = Mounting screws: ISO 4762-M4x25-8.8. Tightening torque 2.2 Nm ± 0.13 Nm. A suitable anti-rotation lock is to be used for the screw connection (e.g. screw with material bonding anti-rotation lock, ISO 4762-M4x25-8.8 MKL as per DIN 267-27 ID 202264-88).
- ⑥ = Space necessary when encoder cover is closed
- ⑦ = Space required when encoder cover is open
- ⑧ = Coaxiality of stator mating surface
- ⑨ = Chamfer at start of thread is obligatory for materially bonding anti-rotation lock
- ⑩ = Bearing surface of stator
- ⑪ = Bearing surface of rotor
- ⑫ = Direction of shaft rotation for output signals according to interface description

| Specifications | ECI 4090S – Singletum |
|---|--|
| Consisting of | AE ECI4090S scanning unit: ID 1087527-02 |
| | TTR EXI4000 scale drum: ID 1113606-02 |
| Functional safety For applications up to | As single-encoder system for monitoring and closed-loop functions <ul style="list-style-type: none"> • SIL 2 according to EN 61 508 (further basis for testing: EN 61 800-5-2) • Category 3, PL d according to EN ISO 13849-1:2015 Safe in the singletum range |
| PFH ¹⁾ | SIL 2: $\leq 27 \cdot 10^{-9}$ (Probability of dangerous Failure per Hour) |
| Safe position ²⁾ | Encoder: $\pm 0.44^\circ$ (safety-related measuring step: SM = 0.176°) Mechanical coupling: $\pm 0.5^\circ$ (Fault exclusion for the loosening of AE scanning unit and TTR scale drum, designed for acceleration of AE: $\leq 400 \text{ m/s}^2$; of TTR: $\leq 600 \text{ m/s}^2$) |
| Interface/ordering designation | DRIVE-CLiQ/DQ01 |
| Firmware | 01.32.27.11 |
| Siemens software (version: 14.72016) | SINAMICS, SIMOTION: \geq V4.6 HF3; SINUMERIK with Safety: \geq V4.7 SP1 HF1 |
| Position values/revolution | 1 048 576 (20 bits) |
| Processing time TIME_MAX_ACTVAL | $\leq 11 \mu\text{s}$ |
| System accuracy | $\pm 40''$ |
| Electrical connection | 15-pin PCB connector (with connection for external temperature sensor ³⁾) |
| Cable length ⁴⁾ | $\leq 40 \text{ m}$ (see description in the brochure <i>Interfaces of HEIDENHAIN encoders</i>) |
| Voltage supply | DC 24 V (10 V to 28.8 V); up to 36 V possible without compromising functional safety |
| Power consumption ⁵⁾ (maximum) | At 10 V: $\leq 1100 \text{ mW}$; at 28.8 V: $\leq 1250 \text{ mW}$ |
| Current consumption (typical) | At 24 V: 40 mA (without load) |
| Shaft | Hollow through shaft $\varnothing 180 \text{ mm}$ (with keyway) |
| Speed | $\leq 6000 \text{ rpm}$ |
| Moment of inertia of rotor | $3.1 \cdot 10^{-3} \text{ kgm}^2$ (without screws, without machine key) |
| Angular acceleration of rotor | $\leq 2 \cdot 10^4 \text{ rad/s}^2$ |
| Axial motion of measured shaft | $\leq \pm 1.5 \text{ mm}$ |
| Vibration 55 to 2000 Hz ⁶⁾ Shock 6 ms | AE scanning unit: $\leq 400 \text{ m/s}^2$; TTR scale drum: $\leq 600 \text{ m/s}^2$ (EN 60 068-2-6) $\leq 2000 \text{ m/s}^2$ (EN 60 068-2-27) |
| Operating temperature | $-40 \text{ }^\circ\text{C}$ to $100 \text{ }^\circ\text{C}$ (at the measuring point and the entire scale drum) |
| Trigger threshold of error message for excessive temperature | $120 \text{ }^\circ\text{C}$ (measuring accuracy of internal temperature sensor: $\pm 1 \text{ K}$) |
| Relative humidity | $\leq 93 \%$ ($40 \text{ }^\circ\text{C}/21 \text{ d}$ as per EN 60 068-2-78); without condensation |
| Protection EN 60529 | Complete encoder in mounted condition: IP20 ⁷⁾ ; Scanning unit: IP40 (see <i>Insulation</i> under <i>Electrical safety</i> in the brochure <i>Interfaces of HEIDENHAIN Encoders</i>) |
| Mass | AE scanning unit: $\approx 0.39 \text{ kg}$; TTR scale drum: $\approx 0.33 \text{ kg}$ |

¹⁾ For altitude of $\leq 1000 \text{ m}$ above sea level

²⁾ Further tolerances may occur in subsequent electronics after position value comparison (contact manufacturer of subsequent electronics)

³⁾ See *Temperature measurement in motors* in the brochure *Encoders for Servo Drives*

⁴⁾ With encoder cable length (inside the motor) $\leq 1 \text{ m}$

⁵⁾ See *General electrical information* in the brochure *Interfaces of HEIDENHAIN Encoders*

⁶⁾ AE: Hz to 55 Hz constant over 6.5 mm distance peak to peak; TTR: 10 Hz to 55 Hz constant over 10 mm distance peak to peak

⁷⁾ The encoder must be protected in use against abrasive and harmful media. Use an appropriate enclosure if required.

Mounting

The scale drum of the rotary encoder is slid onto the centering collar of the measured shaft with machine key and fastened. The stator is mounted via an external centering diameter. In each case, use screws with materially bonding anti-rotation lock (see *Mounting accessories*).

Conditions required on the motor side for a safe mechanical connection:

| | Mating shaft/mating stator | |
|---|--|--|
| Material | Steel | Aluminum |
| Tensile strength R_m | $\geq 600 \text{ N/mm}^2$ | $\geq 220 \text{ N/mm}^2$ |
| Shear strength τ_m | $\geq 390 \text{ N/mm}^2$ | $\geq 130 \text{ N/mm}^2$ |
| Interface pressure P_G | $\geq 660 \text{ N/mm}^2$ | $\geq 250 \text{ N/mm}^2$ |
| Surface roughness R_z | $\leq 16 \mu\text{m}$ | |
| Coefficient of thermal expansion α_{therm} (at 20 °C) | $(10 \text{ to } 17) \cdot 10^{-6} \text{ K}^{-1}$ | $\leq 25 \cdot 10^{-6} \text{ K}^{-1}$ |

Protection against contact (EN 60529)

After encoder installation, all rotating parts must be protected against accidental contact during operation.

Mounting accessories

Screws

Screws are not included in delivery. They can be ordered separately.

| ECI 4090S | Screws | | Lot size |
|--|--------------------------------|--------------|------------------|
| Mounting screws For stator and rotor | ISO 4762- M4x25-8.8-MKL | ID 202264-88 | 60 or 300 pieces |

¹⁾ With coating for materially bonding anti-rotation lock

Please note the information on screws from HEIDENHAIN in the catalog titled *Encoders for Servo Drives*, chapter *General mechanical information* under *Rotary encoders with functional safety*.

Machine key

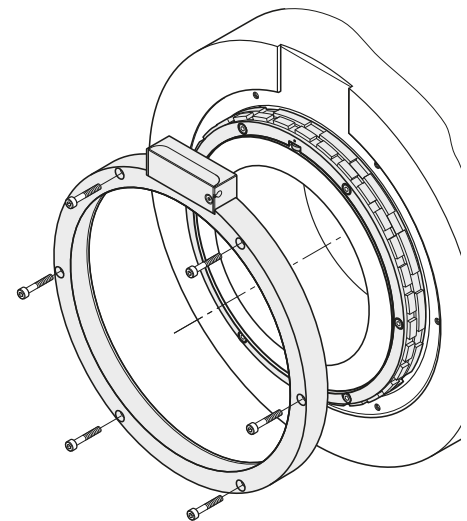
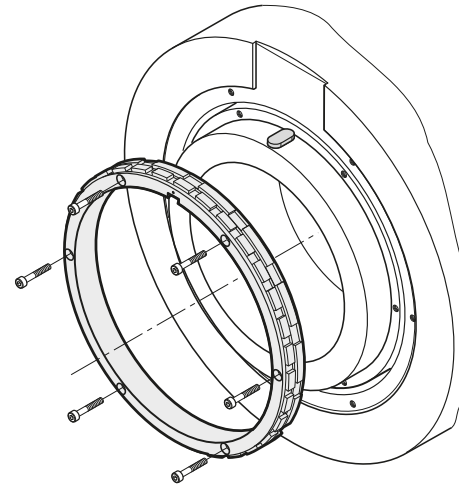
The machine keys are not included in delivery.

Mounting aid

The mounting aid serves to plug and unplug the PCB connector. It prevents damage to the wires and crimp contacts because the strain is applied only to the connector. The wires must not be pulled.

ID 1075573-01

For further mounting information and mounting aids, refer to the *Encoders for Servo Drives* catalog.



Integrated temperature evaluation

This rotary encoder features an internal temperature sensor integrated in 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-CLiQ interface. Note that temperature measurement and transmission are not secure in the sense of functional safety.

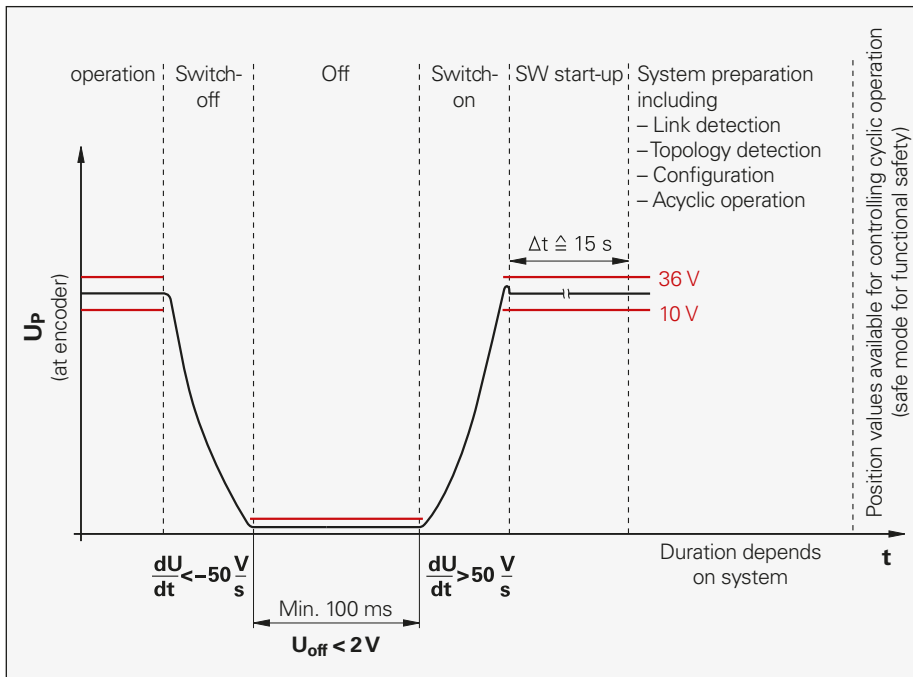
The temperature ascertained by the internal temperature sensor is higher by a device-specific and application-specific amount than the temperature at the measuring point M1 in accordance with the dimension drawing. When the trigger threshold is exceeded for the internal temperature, the encoder issues the error message "Alarm 135." This threshold depends on the encoder model and is shown in the specifications. Keeping a sufficient distance from the error-message threshold is recommended during operation.

The encoder's intended use requires compliance with the operating temperature at the measuring point M1.

DRIVE-CLiQ is a registered trademark of SIEMENS AG.


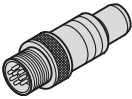


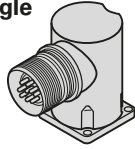


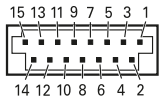
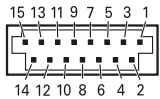




Electrical requirements

Switch-on and switch-off conditions



Electrical connection – pin layout

Pin layout of ECI

| 8-pin coupling M12 | | 9-pin right-angle socket M23 | | | | 15-pin PCB connector | | | | |
|---|---|---|---|---|--|---|---|---|------------------------------------|------------------------------------|
|  |  |  |  |  |  |  |  |  | | |
| | Power supply | | | | Serial data transfer | | | | Other signals ¹⁾ | |
|  M12 | 8 | 2 | 5 | 1 | 3 | 4 | 7 | 6 | / | / |
|  M23 | 3 | 7 | 4 | 8 | 5 | 6 | 1 | 2 | / | / |
|  | 13 | 11 | 14 | 12 | 7 | 8 | 9 | 10 | 5 | 6 |
| | – | – | 0V | U_P | RXP | RXN | TXP | TXN | T⁺ ²⁾ | T⁻ ²⁾ |
|  | Brown/ Green | Blue | White/ Green | White | Gray | Pink | Violet | Yellow | Brown | Green |

¹⁾ Only for cables inside the motor housing

²⁾ Connections for external temperature sensor (depending on the encoder cable inside the motor); evaluation optimized for KTY 84-130 (see *Temperature measurement in motors in the Encoders for Servo Drives brochure*)


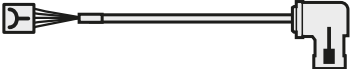

Cable shield connected to housing; **U_P** = Power supply voltage

Note for safety-related applications: Use only DRIVE-CLiQ cable complete with connectors from HEIDENHAIN or SIEMENS. Exchange connectors or modify cables only after consultation with HEIDENHAIN Traunreut.

Vacant pins or wires must not be used.

Electrical connection



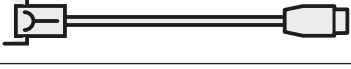
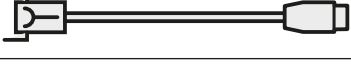

Cables

| | | |
|--|---|--|
| EPG encoder cable inside the motor \varnothing 3.7 mm; [(2 x 2 x 0.06) + (4 x 0.06)] mm ² ; $A_P = 0.06$ mm ² ; wires for TPE temperature sensor [2 x 0.16] mm ² | | |
| Complete with PCB connector (15-pin) and M23 SpeedTEC right-angle socket (male) 9-pin; wires for temperature sensor |  | ID 1125403-N3 ¹⁾ ; length 0.3 m |
| Complete with PCB connector (15-pin) and M23 SpeedTEC right-angle socket (male) 9-pin |  | ID 1125408-N3 ¹⁾ ; length 0.3 m |
| Complete with PCB connector (15-pin) and M12 coupling (male) |  | ID 1160559-01 ²⁾ ; length 1 m |

CE compliance of the complete system must be documented.

¹⁾ Operating temperature range (conditional): -20 °C to 120 °C

²⁾ Operating temperature range (conditional): -40 °C to 85 °C

| | | |
|--|---|---------------|
| PUR connecting cable \varnothing 6.8 m; [(2 x 0.17 mm ²) + (2 x 0.24 mm ²)]; $A_P = 0.24$ mm ² | | |
| Complete with M12 connector (female) and M12 coupling (male), 8 pins each |  | ID 822504-xx |
| Complete with 8-pin M12 connector (female) and Siemens RJ45 connector (IP67) |  | ID 1094652-xx |
| Complete with 8-pin M12 connector (female) and Siemens RJ45 connector (IP20) |  | ID 1093042-xx |
| Complete with M23 SpeedTEC connector (female) and Siemens RJ45 connector (IP20) |  | ID 1121546-xx |
| Complete with M23 SpeedTEC connector (female) and M12 coupling (male), 8-pin |  | ID 1121536-xx |

A_P : Cross section of power supply lines

Encoder cables may need strain relief. For cable lengths > 0.5 m always provide strain relief.

SpeedTEC is a registered trademark of Intercontec Pfeiffer Industriesteckverbindungen GmbH.

DRIVE-CLiQ is a registered trademark of SIEMENS AG.

HEIDENHAIN

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This Product Information 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.



For more information:

Comply with the requirements described in the following documents to ensure the correct operation of the encoder:

- Encoders for Servo Drives brochure: 208922-xx
- Mounting instructions for AE ECI4090S: 1214406-xx and for TTR EXI4000: 1214404-xx
- Interfaces of HEIDENHAIN Encoders brochure: 1078628