



# HEIDENHAIN



**Functional  
Safety**

Product Information

**ECN 424 S**  
**EQN 436 S**

Absolute Rotary Encoder  
with DRIVE-CLiQ Interface  
for Safety-Related  
Applications

Firmware 53

06/2022

# ECN 424S, EQN 436S

Rotary encoders for absolute position values with safe singleturn information

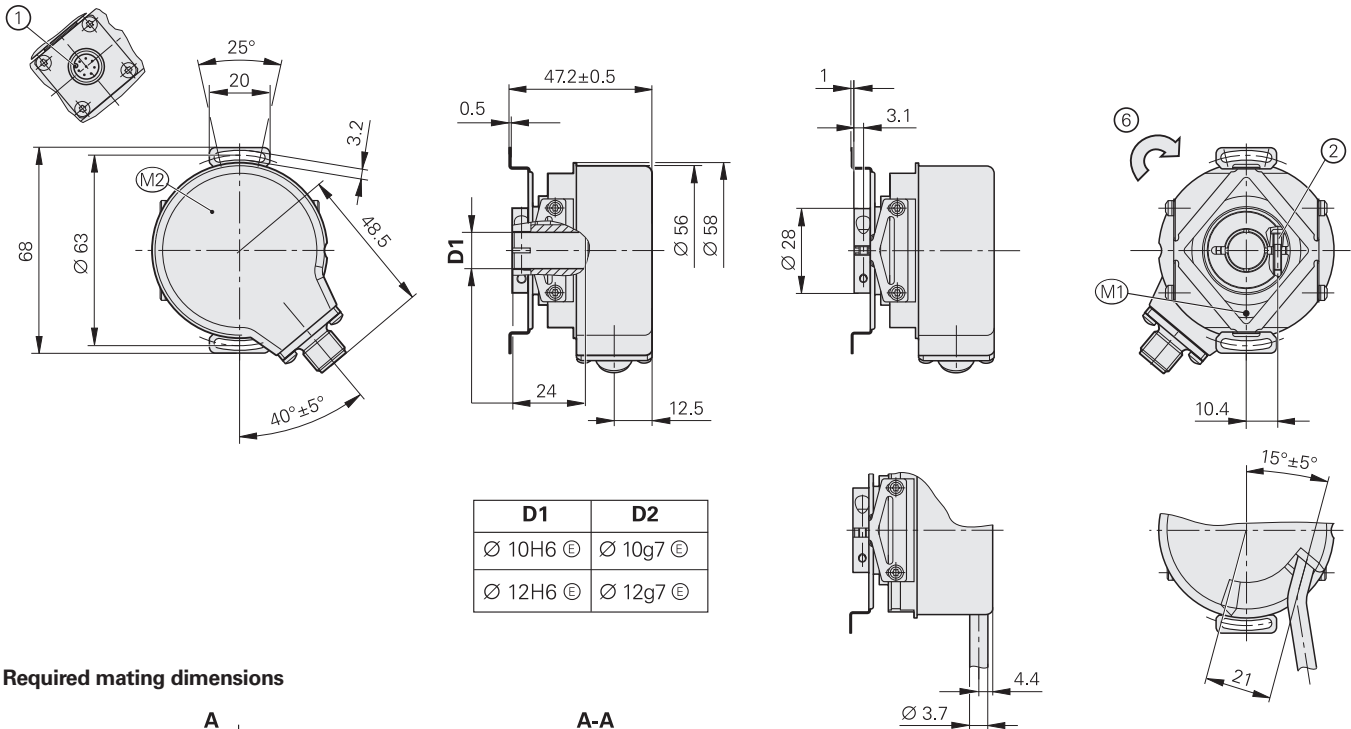
• Blind hollow shaft with steel clamping ring:

Ø 12 mm (68S)

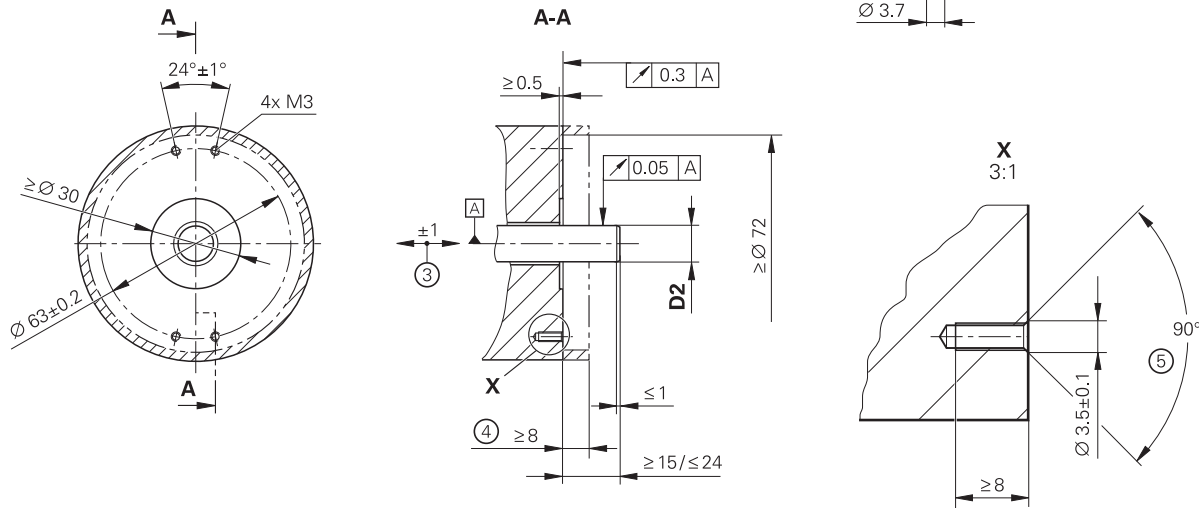
Ø 10 mm (68T)



**Functional Safety**



## Required mating dimensions



mm  
 Tolerancing ISO 8015  
 ISO 2768:1989-mH  
 $\leq 6$  mm:  $\pm 0.2$  mm

- $\square$  = Bearing of mating shaft
- M1 = Measuring point for operating temperature
- M2 = Measuring point for vibration
- 1 = Connector coding
- 2 = X8 clamping screw with hexalobular socket; tightening torque: 1 Nm  $\pm$  0.06 Nm
- 3 = Compensation of mounting tolerances and thermal expansion; no dynamic motion permitted
- 4 = Protection against contact as per EN 60529
- 5 = Chamfer at start of thread is obligatory for material bonding anti-rotation lock; screw: ISO 4762 – M3x8 – 8.8 – MKL; tightening torque: 1 Nm  $\pm$  0.06 Nm
- 6 = Direction of shaft rotation for ascending position values

| Specifications  | ECN 424 S   | EQN 436 S  |
|---|---|--|
| <b>Functional safety</b><br>for applications with up to | As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> <li>• SIL 2 as per EN 61508 (further basis for testing: IEC 61800-5-3)</li> <li>• Category 3, PL d, according to EN ISO 13849-1:2015</li> </ul> Safe in the singleturn range |  |
| PFH <sup>1)</sup>                                       | $\leq 27 \cdot 10^{-9}$ (probability of dangerous failure per hour)   |  |
| Safe position <sup>2)</sup>                             | Encoder: $\pm 1.76^\circ$ (safety-related measuring step: SM = $0.7^\circ$ )<br>Mechanical coupling: $\pm 2^\circ$ (exclusion for loosening of shaft and stator coupling; designed for accelerations of $\leq 150 \text{ m/s}^2$ )  |  |
| <b>Interface/ordering designation</b>                   | DRIVE-CLiQ / DQ01   |  |
| Firmware  | 01.32.26.53   |  |
| SINAMICS SIMOTION <sup>3)</sup>                         | $\geq$ V4.4 HF4   |  |
| SINUMERIK with safety <sup>3)</sup>                     | $\geq$ V4.4 SP2   |  |
| SINUMERIK without safety <sup>3)</sup>                  | $\geq$ V4.4 SP1 HF3   |  |
| Position values per revolution                          | 16777216 (24 bits)  |  |
| Revolutions   | –   | 4096 (12 bits)   |
| Calc. time TIME_MAX_ACTVAL <sup>6)</sup>                | $\leq 8 \mu\text{s}$  |  |
| <b>System accuracy</b> (at 20 °C)                       | $\pm 20''$  |  |
| <b>Electrical connection</b> <sup>4)</sup>              | <b>8-pin M12 radial flange socket</b> or 1 m cable (EPG) with 8-pin M12 coupling <sup>5)</sup>  |  |
| Supply voltage  | DC 24 V (10 V to 28.8 V)<br>(up to DC 36.0 V possible without impairment of functional safety)  |  |
| Power consumption (max.)                                | At 10 V: $\leq 950 \text{ mW}$<br>At 28.8 V: $\leq 1000 \text{ mW}$   | At 10 V: $\leq 1050 \text{ mW}$<br>At 28.8 V: $\leq 1150 \text{ mW}$ |
| Current consumption (typical)                           | At 24 V: 38 mA (without load)   | At 24 V: 43 mA (without load)  |
| Cable length  | $\leq 40 \text{ m}$ <sup>5)</sup>   |  |

**Bold:** This preferred version is available on short notice.

<sup>1)</sup> For use at  $\leq 1000 \text{ m}$  above sea level ( $\leq 6000 \text{ m}$  above sea level upon request)

<sup>2)</sup> Further tolerances may arise in the downstream electronics after position value comparison (contact manufacturer)

<sup>3)</sup> See Siemens document "Certified encoders with DRIVE-CLiQ Dependencies on SIMOTION / SINUMERIK and SINAMICS Hardware and Software versions"

<sup>4)</sup> Cable outlet with cable length  $> 0.5 \text{ m}$  requires strain relief for the cable;  
flange socket versions may be used only with plastic-coated M12 mating connector

<sup>5)</sup> See also the *Cables and Connectors* brochure, as well as the *Interfaces of HEIDENHAIN Encoders* brochure

<sup>6)</sup> The calculation time TIME\_MAX\_ACTVAL specifies the earliest time (relative to the request time) after which the transfer of data from the encoder to the control can begin (data such as position or diagnostic data)

DRIVE-CLiQ is a registered trademark of Siemens AG

| Specifications  | ECN 424 S   | EQN 436 S  |
|---|---|--|
| <b>Shaft*</b>   | Blind hollow shaft Ø 12mm/Ø 10 mm   |  |
| Speed <sup>1)</sup>   | ≤ 6000 rpm  |  |
| Starting torque (at 20 °C)  | ≤ 0.01 Nm   |  |
| Moment of inertia of rotor  | ≤ 6 · 10 <sup>-6</sup> kgm <sup>2</sup>   |  |
| Angular acceleration of rotor   | ≤ 4 · 10 <sup>4</sup> rad/s <sup>2</sup>  |  |
| Axial motion of the measured shaft  | ≤ ±1 mm   |  |
| <b>Vibration</b> 55 Hz to 2000 Hz <sup>2)</sup><br><b>Shock</b> 6 ms          | ≤ 150 m/s <sup>2</sup> (EN 60068-2-6)<br>≤ 2000 m/s <sup>2</sup> (EN 60068-2-27)  |  |
| <b>Operating temperature</b> <sup>3)</sup>                                    | -30 °C to 100 °C  |  |
| <b>Trigger threshold</b> for exceeded temperature error message <sup>4)</sup> | 117 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: ±2 K at 117 °C)   |  |
| <b>Relative humidity</b>  | ≤ 93% (40 °C/21 d as per EN 60068-2-78), condensation excluded  |  |
| <b>Protection rating</b> EN 60529   | IP67 on housing; IP64 at shaft inlet<br>(read about insulation under <i>Electrical safety</i> in the <i>Interfaces of HEIDENHAIN Encoders</i> brochure; contamination from the ingress of fluids must be avoided) |  |
| <b>Mass</b>   | ≈ 0.3 kg  |  |
| <b>ID number</b>  | 1179146-07<br><b>1179146-08</b><br>1179146-09<br><b>1179146-11</b>  | <b>1179147-08</b><br>1179147-09<br><b>1179147-10</b><br>1179147-11 |

**Bold:** This preferred version is available on short notice

\* Please select when ordering

1) At ≥ 2 position requests per revolution

2) 10 Hz to 55 Hz constant over 4.9 mm peak to peak

3) For information on operating temperature, shaft speed, and supply voltage, see *General mechanical information* in the *Rotary Encoders* brochure

4) The internal temperature evaluation is not designed for functional safety

# Mounting

## Mounting

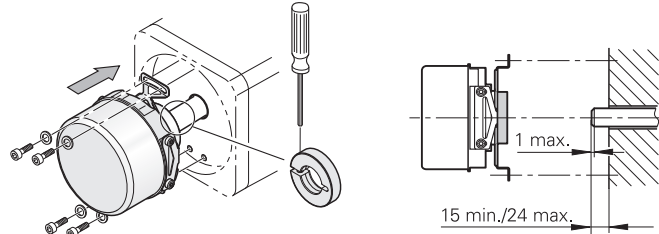
The rotary encoder's hollow shaft is pressed onto the measured shaft and clamped on its rotor side via a screw (tightening torque:  $1 \text{ Nm} \pm 0.06 \text{ Nm}$ ). The stator is connected without a centering collar on a flat surface.

For the hollow-shaft connections 68S and 68T, repeated fastening reduces the screw retaining force. In order to maintain the required safety factor for friction-locked connections, the maximum permissible number of fastening procedures is limited to four. Beyond this number of repetitions, mechanical fault exclusion cannot be guaranteed. In these cases, new clamping rings must be ordered separately:

Clamping ring for 10 mm ID 540741-06  
Clamping ring for 12 mm ID 540741-07

To fasten the stator coupling, use four screws (ISO 4762 - M3 - 8.8 - MKL) with a material bonding anti-rotation lock as per DIN 267-27 and one flat washer each as per ISO 7092. The minimum engagement depth is 6 mm. Note the curing time for the material bonding anti-rotation lock!

With standard stator coupling  
Blind hollow shaft



### More information:

For the customer-side mounting design, the material specifications for steel apply to the customer-side shaft. For the customer-side stator, the material specifications for aluminum apply.

In addition, take into account the material properties, mounting information and mounting aids in the mounting instructions and in the *Rotary Encoders* brochure.

The firmware version can be read out over the DRIVE-CLiQ parameter "Act\_FW\_Version" (index 0). The final two digits of the displayed value are decisive.

With EnDat 2.2 encoders, valuation numbers can be read cyclically from the encoder to evaluate its functioning. The valuation numbers provide the current state of the encoder and ascertain the encoder's "function reserves." These function reserves are also transmitted via the DRIVE-CLiQ interface and can be displayed in the higher-level control. Further information is available from HEIDENHAIN upon request.

# Integrated temperature evaluation

These rotary encoders feature an internal temperature sensor integrated into the encoder electronics. The digitized temperature value is transmitted purely serially via 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 measuring point M1, as shown in the dimension drawing.


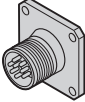
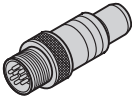



Upon reaching a trigger threshold for the internal temperature sensor, these rotary encoders issue an "Alarm 405" error message. This threshold may vary depending on the encoder and is stated in the specifications. During operation, it is recommended that the temperature be kept adequately below the error-message threshold.

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

DRIVE-CLiQ is a registered trademark of Siemens AG

# Electrical connection

## Pin layout

| 8-pin M12 flange socket or 8-pin M12 coupling                                     |   |             |   |            |   |            |          |             |
|---|---|-------------|---|------------|---|------------|----------|-------------|
|  |  |             |  |            |  |            |          |             |
|   | Power supply  |             | Serial data transmission  |            |   |            |          |             |
|  | <b>1</b>  | <b>5</b>    | <b>7</b>  | <b>6</b>   | <b>3</b>  | <b>4</b>   | <b>2</b> | <b>8</b>    |
|   | <b>U<sub>P</sub></b>  | <b>0V</b>   | <b>TXP</b>  | <b>TXN</b> | <b>RXP</b>  | <b>RXN</b> | /        | /           |
|  | White   | White/Green | Violet  | Yellow     | Gray  | Pink       | Blue     | Brown/Green |

**Cable shield** connected to housing; **U<sub>P</sub>** = Power supply voltage  
Unused pins must not be assigned!



### More information:

For connecting cables and adapter cables, see the *Cables and Connectors* brochure.

DRIVE-CLiQ is a registered trademark of Siemens AG

## HEIDENHAIN

**DR. JOHANNES HEIDENHAIN GmbH**

Dr.-Johannes-Heidenhain-Str. 5

**83301 Traunreut, Germany**

☎ +49 8669 31-0

FAX +49 8669 32-5061

info@heidenhain.de

[www.heidenhain.com](http://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

1379894-xx