



# HEIDENHAIN



**Functional  
Safety**

Product Information

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

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

6FX 2001-5VD13-1AA0  
6FX 2001-5WD13-1AA0  
6FX 2001-5VD25-1AA0  
6FX 2001-5WD25-1AA0

Firmware 53

02/2022

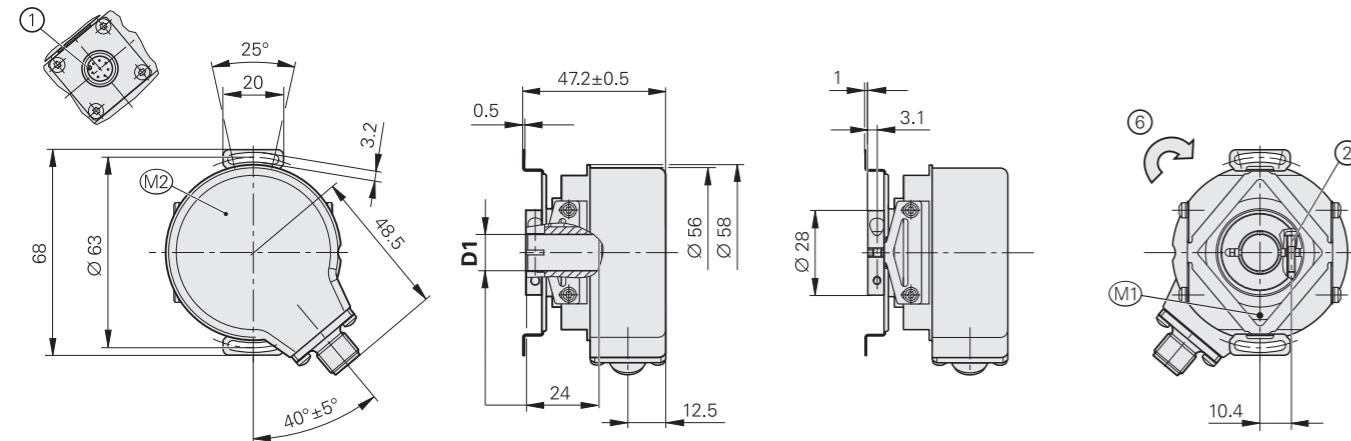
# ECN 424S, EQN 436S

Rotary encoders for absolute position values with safe singleturn information

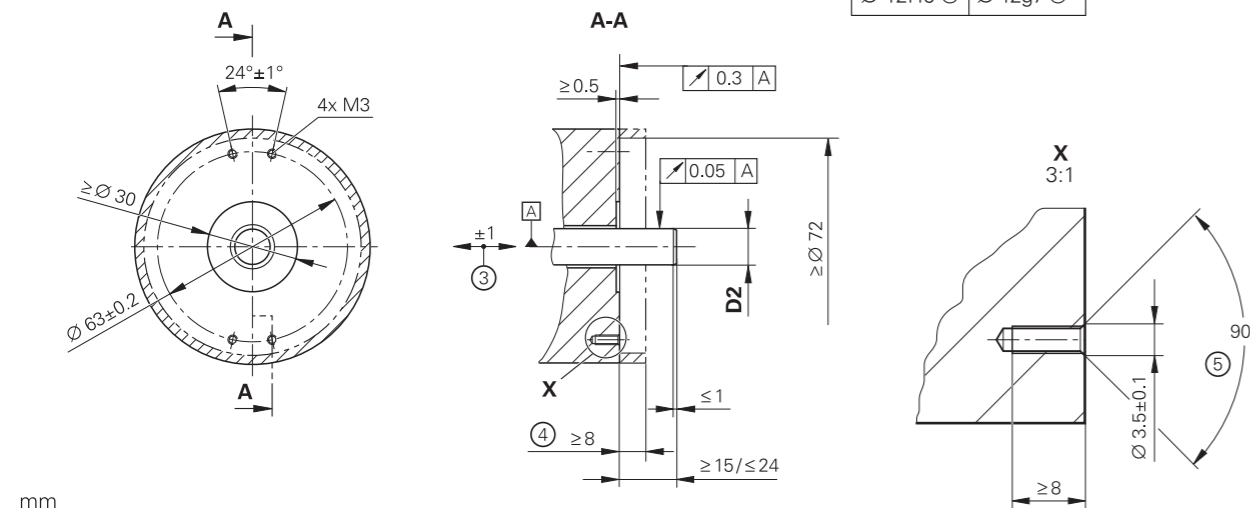
- Blind hollow shaft with steel clamping ring:
  - Ø 12 mm (68S)
  - Ø 10 mm (68T)



## Blind hollow shaft



## Required mating dimensions



mm  
 Tolerancing ISO 8015  
 ISO 2768 - m H  
 ≤ 6 mm: ±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 ±0.06 Nm
- 3 = Compensation of mounting tolerances and thermal expansion; no dynamic motion permitted
- 4 = Protection from 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 ±0.06 Nm
- 6 = Direction of shaft rotation for ascending position values

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

- <sup>1)</sup> For use at ≤ 1000 m above NN (≤ 6000 m above NN upon request)
- <sup>2)</sup> Further tolerances may arise in the downstream electronics after position value comparison (contact mfr.)
- <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 m requires strain relief for the cable; flange socket versions may be used only with plastic-coated M12 mating connectors

DRIVE-CLiQ is a registered trademark of Siemens AG.

Specifications	ECN 424S	EQN 436S
<b>Shaft*</b>	Blind hollow shaft Ø 12 mm/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> <b>Shock</b> 6 ms	≤ 150 m/s <sup>2</sup> (EN 60068-2-6) ≤ 1000 m/s <sup>2</sup> (EN 60068-2-27)	
<b>Operating temperature</b> <sup>3)</sup>	-30 °C to 100 °C	
<b>Trigger threshold for error message due to temperature</b> <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 for housing; IP64 for shaft inlet (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>	1179146-10 (68S) 1179146-12 (68T)	1179147-13 (68S) 1179147-12 (68T)

\* Please select when ordering

<sup>1)</sup> At ≥ 2 position requests per revolution

<sup>2)</sup> 10 Hz to 55 Hz constant over 4.9 mm peak to peak

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

<sup>4)</sup> 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 Nm ±0.06 Nm). The stator is connected without a centering collar on a flat surface.

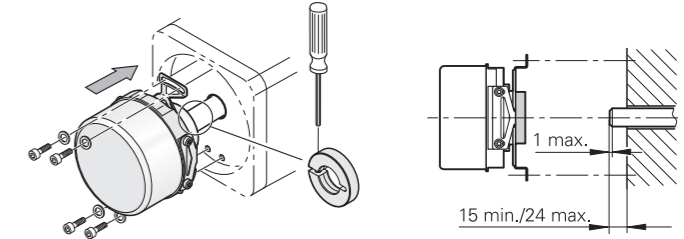
For the hollow-shaft connections 68S and 68T, repeated fastening reduces the screw retaining force. In order to maintain the required safety factor for friction-locked connections, the maximum permissible number of fastening procedures is limited to four. Beyond this number of repetitions, mechanical 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 cohesive anti-rotation lock as per DIN 267-27 and one flat washer each as per ISO 7092. Minimum engagement of 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, and 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 (ID 349529-xx).

## 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. The specific threshold depends on the encoder model and is provided in the specifications. During operation, it is recommended that the temperature be kept adequately below the error-message threshold.

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

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## Electrical connection

### Pin layout

8-pin M12 flange socket or 8-pin M12 coupling								
	Power supply		Serial data transmission					
			Transmit data		Receive data			
	<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>	<b>/</b>	<b>/</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 and adapter cables, see the *Cables and Connectors* brochure (ID 1206103-xx).

## 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 valid when the contract is made.

#### More information:

Comply with the requirements described in the following documents to ensure correct and intended operation:

- Brochure: *Rotary Encoders* 349529-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Mounting Instructions: *ECN 424 S/EQN 436 S* 1163012-xx

For implementation in a control or inverter:

- Application conditions for safe control with HEIDENHAIN DRIVE-CLiQ encoders 579641-xx