



HEIDENHAIN



**Functional
Safety**

Product Information

ECN 424 S EQN 436 S

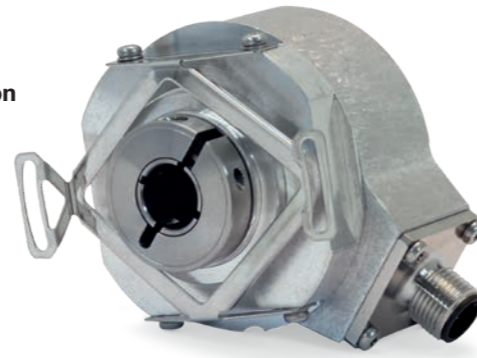
Absolute Rotary Encoders
with DRIVE-CLiQ Interface for
Safety-Related Applications

Firmware 53

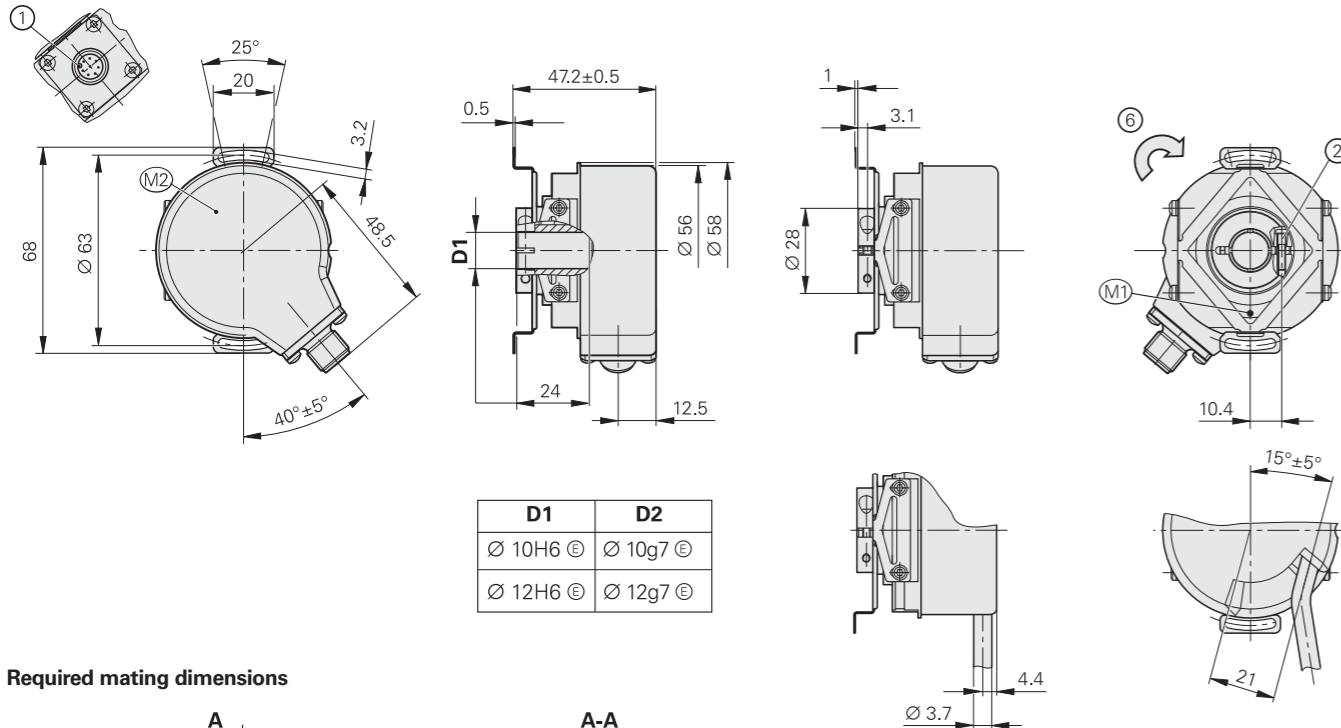
ECN 424S, EQN 436S

Rotary encoders for absolute position measurement with safe singleturn information

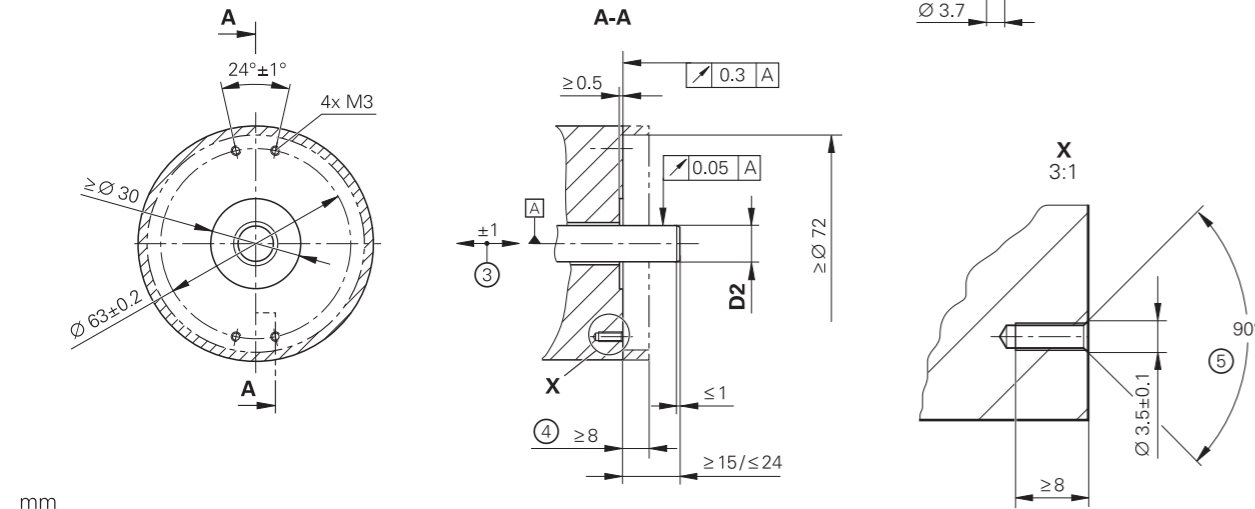
- Blind hollow shaft with steel clamping ring:
 - Ø 12 mm (68S)
 - Ø 10 mm (68T)



Functional Safety



Required mating dimensions



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

- ⊠ = 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 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 ±0.06 Nm
- 6 = Direction of shaft rotation for ascending position values

Specifications	ECN 424S	EQN 436S
Functional safety for applications with up to	As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> SIL 2 as per EN 61508 (further basis for testing: IEC 61800-5-2) Category 3, PL d as per EN ISO 13849-1:2015 Safe in the singleturn range	
PFH ¹⁾	≤ 27 · 10 ⁻⁹ (probability of dangerous failure per hour)	
Safe position ²⁾	Encoder: ±1.76° (safety-related measuring step: SM = 0.7°) Mechanical coupling: ±2° (fault exclusion for loosening of the shaft and stator coupling, designed for accelerations of ≤ 150 m/s ²)	
Interface/ordering designation	DRIVE-CLiQ / DQ01	
Firmware	01.32.26.53	
SINAMICS SIMOTION ³⁾	≥ V4.4 HF4	
SINUMERIK with Safety ³⁾	≥ V4.4 SP2	
SINUMERIK without safety ³⁾	≥ V4.4 SP1 HF3	
Position values per revolution	16777216 (24 bits)	
Revolutions	-	4096 (12 bits)
Calc. time TIME_MAX_ACTVAL ⁶⁾	≤ 8 µs	
System accuracy (at 20 °C)	±20"	
Electrical connection ⁴⁾	8-pin M12 radial flange socket or 1 m cable (EPG) with 8-pin M12 coupling ⁵⁾	
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 ⁵⁾	

Bold: This preferred version is available on short notice.

- ¹⁾ For use at ≤ 1000 m above sea level (≤ 6000 m above sea level upon request)
- ²⁾ Further tolerances may arise in the downstream electronics after position value comparison (contact manufacturer)
- ³⁾ See Siemens document "Certified encoders with DRIVE-CLiQ Dependencies on SIMOTION / SINUMERIK and SINAMICS Hardware and Software versions"
- ⁴⁾ 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 connector
- ⁵⁾ See also the Cables and Connectors brochure, as well as the Interfaces of HEIDENHAIN Encoders brochure
- ⁶⁾ 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)

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Specifications	ECN 424S	EQN 436S
Shaft*	Blind hollow shaft Ø 12 mm / Ø 10 mm	
Speed ¹⁾	≤ 6000 rpm	
Starting torque (at 20 °C)	≤ 0.01 Nm	
Moment of inertia of rotor	≤ 6 · 10 ⁻⁶ kgm ²	
Angular acceleration of rotor	≤ 4 · 10 ⁴ rad/s ²	
Axial motion of the measured shaft	≤ ±1 mm	
Vibration 55 Hz to 2000 Hz ²⁾ Shock 6 ms	≤ 150 m/s ² (EN 60068-2-6) ≤ 1000 m/s ² (EN 60068-2-27)	
Operating temperature ³⁾	-30 °C to 100 °C	
Trigger threshold of error message for excessive temperature ⁴⁾	117 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: ±2 K at 117 °C)	
Relative humidity	≤ 93% (40 °C/21 d as per EN 60068-2-78), condensation excluded	
Protection rating EN 60529	IP67 for housing; IP64 at 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)	
Mass	≈ 0.3 kg	
ID number	1179146-07 1179146-08 1179146-09 1179146-11	1179147-08 1179147-09 1179147-10 1179147-11

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* 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

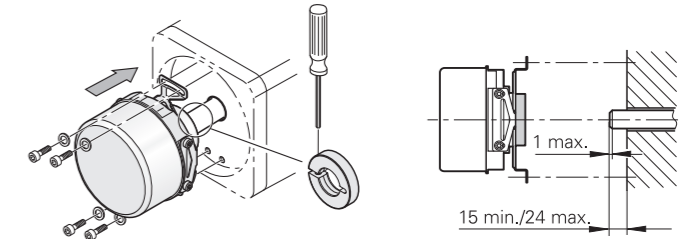
Mounting

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

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. Minimum engagement of 6 mm. Note the curing time for the material bonding anti-rotation lock!

With standard stator coupling
Blind hollow shaft



Further information:

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

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.

Electrical connection

Pin layout

8-pin M12 flange socket or 8-pin M12 coupling								
	Power supply		Serial data transmission					
			Transmit data		Receive data			
	1	5	7	6	3	4	2	8
	U_P	0V	TXP	TXN	RXP	RXN	/	/
	White	White/Green	Violet	Yellow	Gray	Pink	Blue	Brown/Green

Cable shield connected to housing; **U_P** = Power supply voltage
Unused pins must not be assigned!



More information:

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

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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 placed.



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
- Brochure: *Cables and Connectors* 1206103-xx
- Mounting Instructions: *ECN 424S / EQN 436S* 1163012-xx