HEIDENHAIN

Product Information

ECN 424 S
EQN 436 S

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

Firmware 53

Functional Safety

ECN 424 S, EQN 436 S

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

D1	D2
Ø 10H6 Ⓔ	Ø 10g7 Ⓔ
Ø 12H6 Ⓔ	Ø 12g7 Ⓔ
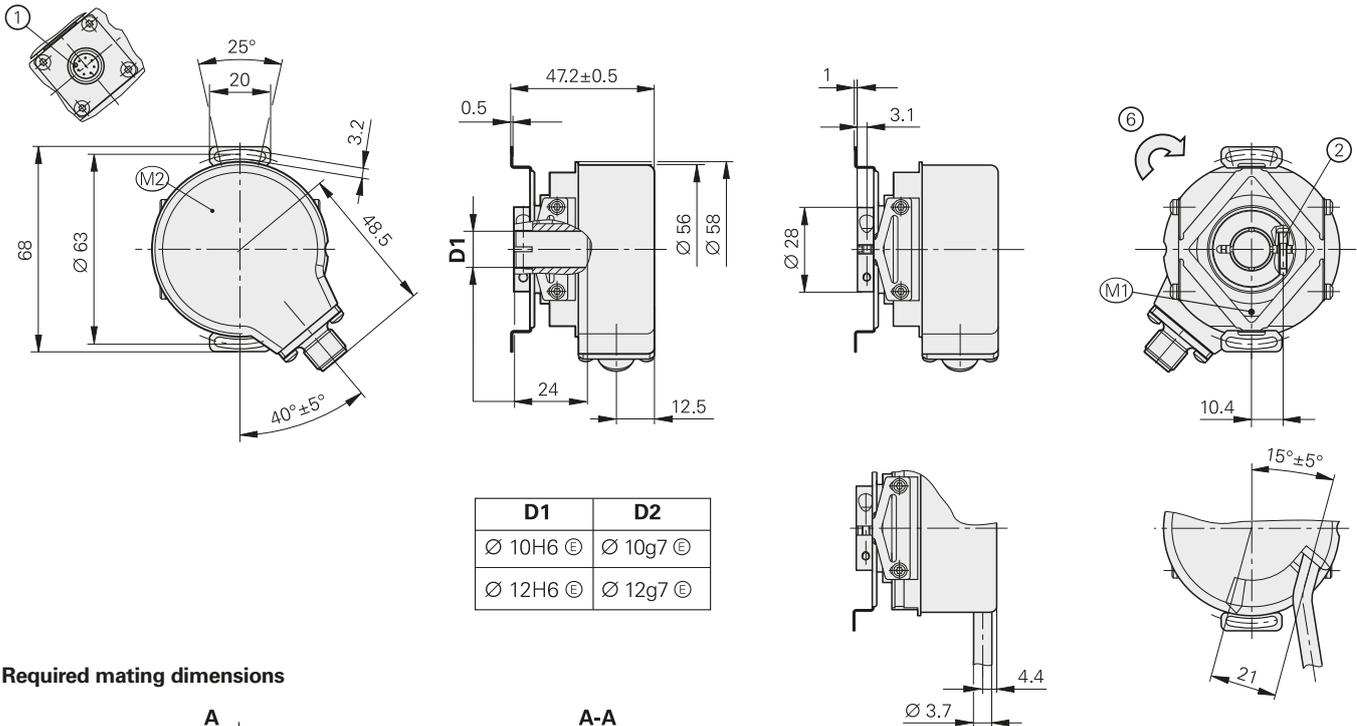
Required mating dimensions
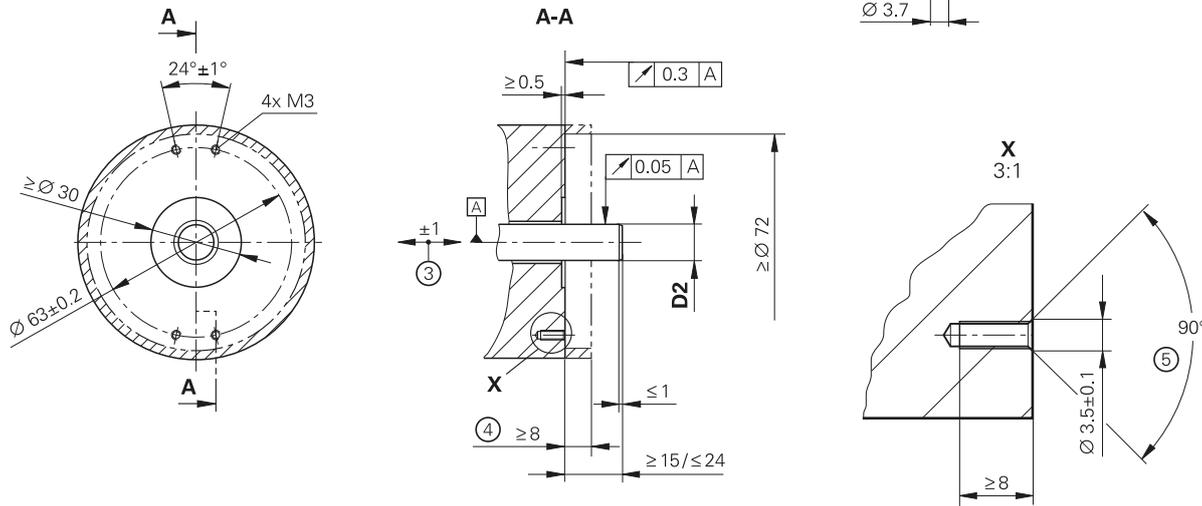
mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm

Ⓐ = Bearing of mating shaft
M1 = Measuring point for operating temperature
M2 = Measuring point for vibration
1 = Connector polarizing key
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 materially bonding anti-rotation lock
6 = Direction of shaft rotation for output signals according to interface description

Specifications	ECN 424S	EQN 436S
Functional safety For applications up to	*As single-encoder system for monitoring and closed-loop functions:* • SIL 2 according to EN 61508 (further basis for testing: EN 61800-5-2) • Category 3, PL d as per EN ISO 13849-1:2008 Safe in the singleturn range	
PFH[1]	$\leq 27 \times 10^{-9}$ (Probability of dangerous Failure per Hour)	
Safe position[2]	*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^2)	
Interface	DRIVE-CLiQ	
Ordering designation	DQ01	
Firmware	01.32.26.53	
Siemens software (date: Feb. 12, 2014)	*Sinamics Simotion:* ≥ V4.4 HF4; *Sinumerik with safety:* ≥ V4.4 SP2	
Position values/revolution	16777216 (24 bits)	
Revolutions	–	4096 (12 bits)
Processing time TIME_MAX_ACTVAL	≤ 8 µs	
System accuracy (at 20 °C)	±20″	
Electrical connection[3]	**M12 flange socket (8-pin) radial** or 1 m cable (EPG) with M12 coupling (8-pin)[4]	
Voltage supply	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:* ≤ 900 mW *At 28.8 V:* ≤ 1000 mW	*At 10 V:* ≤ 1000 mW *At 28.8 V:* ≤ 1140 mW
Current consumption (typical)	*At 24 V:* 38 mA (without load)	*At 24 V:* 43 mA (without load)
Cable length	≤ 40 m[4]	

Bold: This preferred version is available on short notice.
* Please select when ordering
[1] For altitude of ≤ 1000 m above sea level
[2] Further tolerances may occur in subsequent electronics after position value comparison (contact manufacturer of subsequent electronics)
[3] Cable outlet with cable length > 0.5 m requires strain relief of the cable;
   Flange socket versions must only be used with insulated M12 mating connectors
[4] See brochure *Interfaces of HEIDENHAIN encoders*

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Specifications	ECN 424 S	EQN 436 S
Shaft*	Blind hollow shaft D = 12 mm or D = 10 mm	
Speed[1]	≤ 6000 rpm	
Starting torque (at 20 °C)	≤ 0.01 Nm	
Moment of inertia of rotor	≤ 6 x 10^{-6} kgm^2	
Angular acceleration of rotor	≤ 4 x 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 for error message due to 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); without condensation	
Protection EN 60529	IP67 for housing; IP64 at shaft input (see *Insulation* under *Electrical safety* in the brochure *Interfaces of HEIDENHAIN Encoders*; contamination through ingress of liquids must be prevented)	
Mass	≈ 0.3 kg	
ID number	1179146-03/-04/-05/-06	1179147-04/-05/-06/-07

Bold: This preferred version is available on short notice.
* Please select when ordering
[1] With ≥ 2 position requests per revolution
[2] 10 Hz to 55 Hz constant over distance 4.9 mm peak to peak
[3] For information on operating temperature, shaft speeds 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 is slid by its hollow shaft onto the measured shaft and fastened by 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, the repetition of fastening reduces the screw retaining force. In order to maintain the required safety factor for friction-locked connections, the maximum number of permissible fastening repetitions is limited to four. A mechanical fault exclusion cannot be guaranteed for more repetitions.
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 fix the stator coupling, use 4 screws ISO 4762 - M3 - 8.8 - MKL with a cohesive anti-rotation lock as per DIN 267-27 and one flat washer as per ISO 7092. Minimum engagement of 6 mm. Note the curing time for the materially bonding anti-rotation lock!

With standard stator coupling
Blind hollow shaft

1 max.

15 min./24 max.

The following maximum torque M_{max} is to be used when designing the mechanical fault exclusion for the shaft connection:

M_{max} = 1 Nm

The customer's mechanical design must ensure that the maximum torque M_{max} occurring in the application can be transmitted.
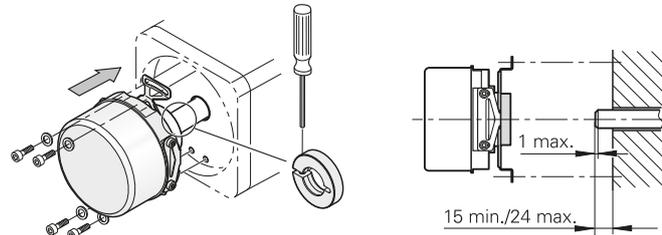
For a safe mechanical coupling, the following prerequisites are to be met by the customer.

	Mating shaft	Mating stator
Material	Steel	Aluminum
Tensile strength R_m	≥ 600 N/mm^2	≥ 220 N/mm^2
Interface pressure P_G	≥ 500 N/mm^2	≥ 200 N/mm^2
Surface roughness R_Z	≤ 16 µm	
Coefficient of thermal expansion α_{therm}	10×10^{-6} K^{-1} to 17×10^{-6} K^{-1}	$\leq 25 \times 10^{-6}$ K^{-1}
Minimum shear strength	Not applicable	120 N/mm^2

📖 **Further information:**

For mounting information and mounting aids, see Mounting Instructions and the *Rotary Encoders brochure.*

Integrated temperature evaluation

These rotary encoders have an internal temperature sensor integrated in the encoder electronics. The digitized temperature value is transmitted purely serially via the DRIVE-CLiQ interface. Note that temperature measurement and transmission are not secure in the sense 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 the measuring point M1 in accordance with the dimension drawing.

When the trigger threshold is exceeded for the internal temperature, the encoders issue the error message "Alarm 405." 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.

Electrical requirements

Switch-on and switch-off conditions

Diagram axes and labels:

- U_p (at the encoder) — vertical axis
- t — horizontal axis
- Phases: Operation | Switch-off | Off | Switch-on | Start-up | Ready for operation
- 36 V (without reducing the functional safety)
- Typically 15 s
- 28.8 V
- Up min.
- $\frac{dU}{df} < -50\,\frac{V}{s}$
- $\frac{dU}{df} > 50\,\frac{V}{s}$
- min. 100 ms
- Uoff < 2 V
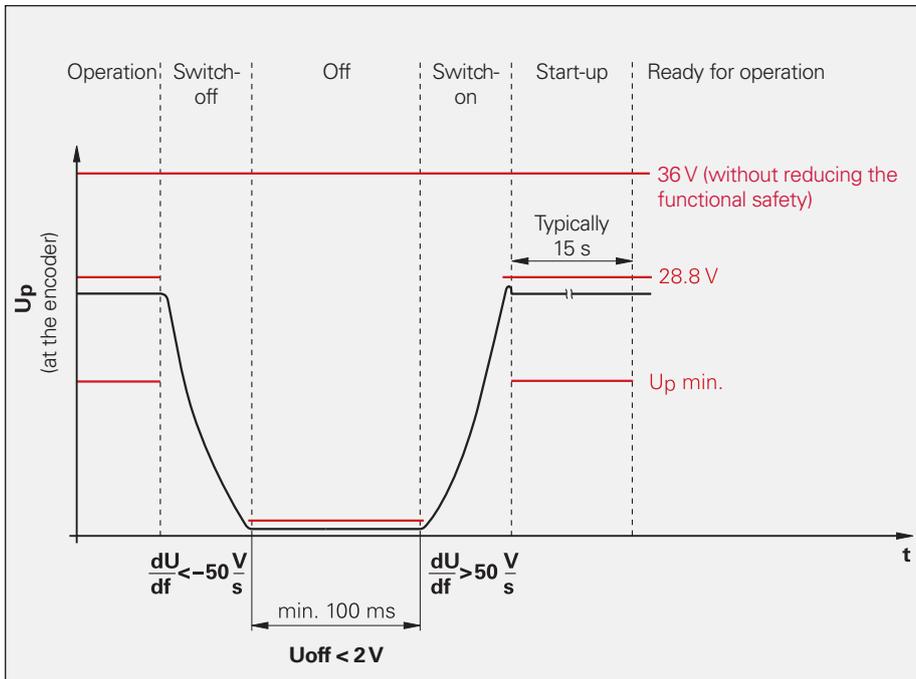
Diagnostic and testing equipment

PWM 21

The PWM 21 phase angle measuring unit serves together with the provided ATS adjusting and testing software for diagnosis and adjustment of HEIDENHAIN encoders.

Further information:

Product Information:
PWM 21/ATS software.

	PWM 21
Encoder input	• EnDat 2.1 or EnDat 2.2 (absolute value with or without incremental signals) • DRIVE-CLiQ • Fanuc Serial Interface • Mitsubishi high speed interface • Yaskawa Serial Interface • Panasonic serial interface • SSI • 1 V_{PP}/TTL/11 μA_{PP} • HTL (via signal adapter)
Interface	USB 2.0
Voltage supply	AC 100 V to 240 V or DC 24 V
Dimensions	258 mm x 154 mm x 55 mm

	ATS
Languages	Choice between English and German
Functions	• Position display • Connection dialog • Diagnostics • Mounting wizard for EBI/ECI/EQI, LIP 200, LIC 4000 and others • Additional functions (if supported by the encoder) • Memory contents
System requirements and recommendations	PC (dual-core processor > 2 GHz) RAM > 2 GB Operating systems: Windows Vista (32-bit), 7, 8, and 10 (32-bit/64-bit) 500 MB free space on hard disk

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Electrical connection

Pin layout

8-pin flange socket or coupling M12						
	Voltage supply		Serial data transfer			
			Transmit data		Receive data	
◼	**1**	**5**	**7**	**6**	**3**	**4**
	U$_P$	0 V	TXP	TXN	RXP	RXN

Cable shield connected to housing; **U$_P$** = Power supply voltage

Cables with M12 connecting elements

PUR Connecting cables and adapter cables $\varnothing$ 6.8 mm; [2(2 × 0.17 mm^2) + (2 × 0.24 mm^2)]; A$_P$ = 0.24 mm^2		
Complete With M12 connector (female) and M12 coupling (male), 8-pin		822504-xx
Complete With M12 connector (female), 8-pin, and Siemens RJ45 connector (IP67)		1094652-xx
Complete With M12 connector (female), 8-pin, and Siemens RJ45 connector (IP20)		1093042-xx

A$_P$: Cross section of power supply lines

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