



# HEIDENHAIN



Product Information

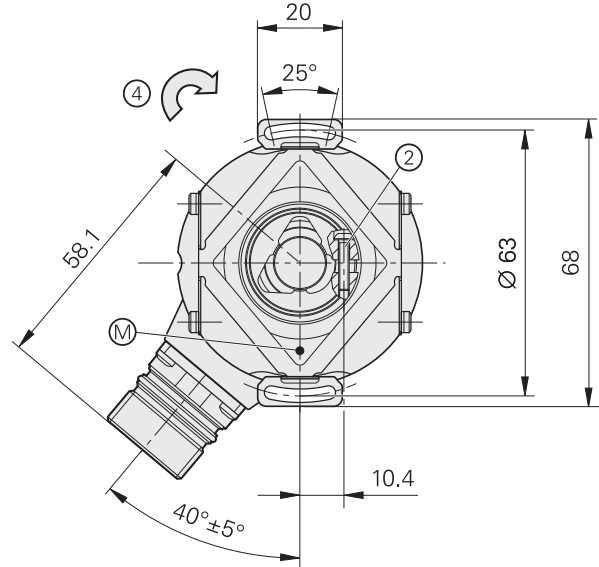
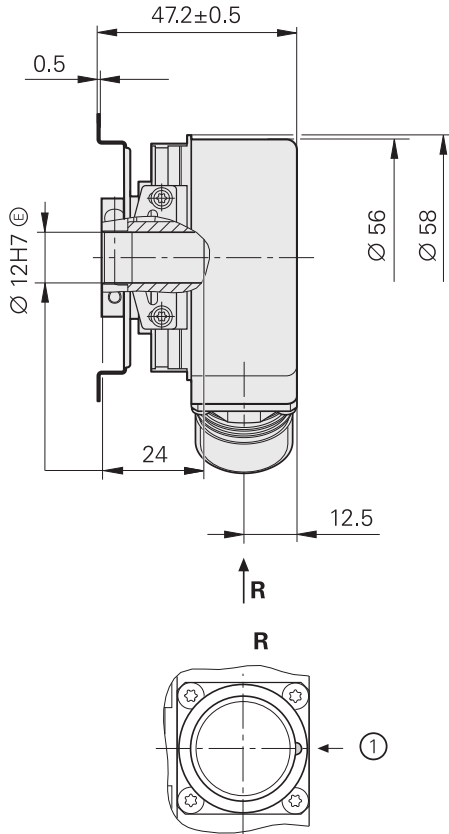
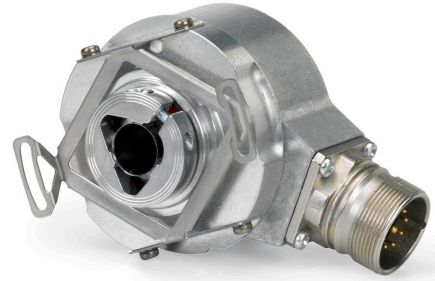
## **EQN 425**

Absolute Rotary Encoders with TTL  
or HTL Signals

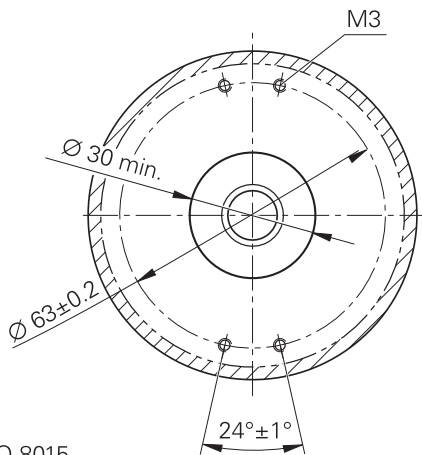
# EQN 425

Rotary encoder for absolute position values with blind hollow shaft

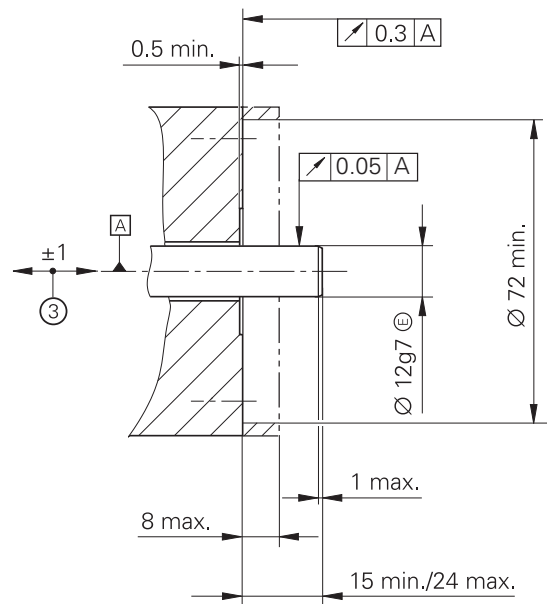
- Stator coupling for plane surface
- EnDat or SSI interface
- Additional incremental signals with TTL or HTL levels



## Required mating dimensions



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



▣ = Bearing of mating shaft

M = Measuring point for operating temperature

1 = Connector coding

2 = Clamping screw with X8 hexalobular socket. Tightening torque 1.1 ± 0.1 Nm

3 = Compensation of mounting tolerances and thermal expansion, no dynamic motion permitted

4 = Direction of shaft rotation for output signals as per the interface description

Specifications	Absolute						
	EQN 425 – Multiturn						
Interface	EnDat 2.2						
Ordering designation *	EnDatH				EnDatT		
Position values per revolution	8192 (13 bits)						
Revolutions	4096 (12 bits)						
Code	Pure binary						
Calculation time $t_{cal}$ Clock frequency	$\leq 9 \mu s$ $\leq 2 \text{ MHz}$						
Incremental signals	HTL				TTL		
Signal periods *	256	512	1024	2048	512	2048	4096
Edge separation a	$\geq 3.3 \mu s$	$\geq 2.4 \mu s$	$\geq 0.8 \mu s$	$\geq 0.6 \mu s$	$\geq 2.4 \mu s$	$\geq 0.6 \mu s$	$\geq 0.2 \mu s$
Output frequency	$\leq 26 \text{ kHz}$	$\leq 52 \text{ kHz}$	$\leq 103 \text{ kHz}$	$\leq 205 \text{ kHz}$	$\leq 52 \text{ kHz}$	$\leq 205 \text{ kHz}$	$\leq 410 \text{ kHz}$
System accuracy <sup>1)</sup>	$\pm 60''$	$\pm 60''$	$\pm 60''$	$\pm 20''$	$\pm 60''$	$\pm 20''$	$\pm 20''$
Electrical connection	M23 flange socket (male) 17-pin, radial						
Cable length <sup>2)</sup>	$\leq 100 \text{ m}$ (with HEIDENHAIN cable)						
Power supply	10 V to 30 V DC				4.75 V to 30 V DC		
Power consumption <sup>3)</sup> (maximum)	See <i>Power consumption</i> diagram				At 4.75 V: $\leq 900 \text{ mW}$ At 30 V: $\leq 1100 \text{ mW}$		
Current consumption (typical, without load)	At 10 V: $\leq 56 \text{ mA}$ At 24 V: $\leq 34 \text{ mA}$				At 5 V: $\leq 100 \text{ mA}$ At 24 V: $\leq 25 \text{ mA}$		
Shaft	Blind hollow shaft $\varnothing 12 \text{ mm}$						
Speed $n$ <sup>4)</sup>	$\leq 6000 \text{ min}^{-1}$						
Starting torque at 20 °C	$\leq 0.01 \text{ Nm}$						
Moment of inertia of rotor	$4.3 \times 10^{-6} \text{ kgm}^2$						
Axial motion of measured shaft	$\leq \pm 1 \text{ mm}$						
Vibration 10 to 2000 Hz <sup>5)</sup> Shock 6 ms	$\leq 150 \text{ m/s}^2$ (EN 60 068-2-6) $\leq 1000 \text{ m/s}^2$ (EN 60 068-2-27)						
Operating temperature <sup>4)</sup>	-40 °C to 100 °C						
Protection EN 60 529	Housing: IP 67 Shaft exit: IP 64						
Weight	$\approx 0.30 \text{ kg}$						

\* Please select when ordering

- 1) For absolute position value; accuracy of the incremental signal upon request
- 2) For HTL signals, the maximum cable length depends on the output frequency (see *Cable length for HTL diagrams*)
- 3) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* catalog
- 4) For the correlation between the operating temperature and the shaft speed or supply voltage, see *General mechanical information* in the *Rotary Encoders* catalog
- 5) 10 Hz to 55 Hz, constant over distance, 4.9 mm peak to peak

Specifications	Absolute						
	EQN 425 – Multiturn						
Interface	SSI						
Ordering designation *	SSI41H				SSI41T		
Position values per revolution	8192 (13 bits)						
Revolutions	4096 (12 bits)						
Code	Gray						
Calculation time $t_{cal}$ Clock frequency	$\leq 5 \mu s$ $\leq 1 \text{ MHz}$						
Incremental signals *	HTL or HTLs				TTL		
Signal periods *	256	512	1024	2048	512	2048	4096
Edge separation a	$\geq 3.3 \mu s$	$\geq 2.4 \mu s$	$\geq 0.8 \mu s$	$\geq 0.6 \mu s$	$\geq 2.4 \mu s$	$\geq 0.6 \mu s$	$\geq 0.2 \mu s$
Output frequency	$\leq 28 \text{ kHz}$	$\leq 52 \text{ kHz}$	$\leq 103 \text{ kHz}$	$\leq 205 \text{ kHz}$	$\leq 52 \text{ kHz}$	$\leq 205 \text{ kHz}$	$\leq 410 \text{ kHz}$
System accuracy <sup>1)</sup>	$\pm 60''$	$\pm 60''$	$\pm 60''$	$\pm 20''$	$\pm 60''$	$\pm 20''$	$\pm 20''$
Electrical connection	M23 flange socket (male) 12-pin, radial				M23 flange socket (male) 17-pin, radial		
Cable length <sup>2)</sup>	$\leq 100 \text{ m}$ (with HEIDENHAIN cable)						
Power supply	10 V to 30 V DC				4.75 V to 30 V DC		
Power consumption <sup>3)</sup> (maximum)	See <i>Power consumption</i> diagram				At 4.75 V: $\leq 900 \text{ mW}$ At 30 V: $\leq 1100 \text{ mW}$		
Current consumption (typical, without load)	At 10 V: $\leq 56 \text{ mA}$ At 24 V: $\leq 34 \text{ mA}$				At 5 V: $\leq 100 \text{ mA}$ At 24 V: $\leq 25 \text{ mA}$		
Shaft	Blind hollow shaft $\varnothing 12 \text{ mm}$						
Speed n <sup>4)</sup>	$\leq 6000 \text{ min}^{-1}$						
Starting torque at 20 °C	$\leq 0.01 \text{ Nm}$						
Moment of inertia of rotor	$4.3 \times 10^{-6} \text{ kgm}^2$						
Axial motion of measured shaft	$\leq \pm 1 \text{ mm}$						
Vibration 10 to 2000 Hz <sup>5)</sup> Shock 6 ms	$\leq 150 \text{ m/s}^2$ (EN 60 068-2-6) $\leq 1000 \text{ m/s}^2$ (EN 60 068-2-27)						
Operating temperature <sup>4)</sup>	-40 °C to 100 °C						
Protection EN 60 529	Housing: IP 67 Shaft exit: IP 64						
Weight	$\approx 0.30 \text{ kg}$						

\* Please select when ordering

- 1) For absolute position value; accuracy of the incremental signal upon request
- 2) For HTL signals, the maximum cable length depends on the output frequency (see *Cable length for HTL* diagrams)
- 3) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* catalog
- 4) For the correlation between the operating temperature and the shaft speed or supply voltage, see *General mechanical information* in the *Rotary Encoders* catalog
- 5) 10 Hz to 55 Hz, constant over distance, 4.9 mm peak to peak

# Diagrams

## Power and current consumption

For encoders with a large supply voltage range, the current consumption has a nonlinear relationship with the supply voltage. It is determined using the calculation described in the *Interfaces of HEIDENHAIN Encoders* catalog.

For the rotary encoders with additional HTL output signals, the power consumption also depends on the output frequency and the cable length. The power consumption values for the HTL or HTLs interface can therefore be taken from the diagrams.

The maximum permissible output frequency is shown in the specifications. It occurs at the maximum permissible shaft speed. The output frequency for any shaft speed is calculated using the following formula:

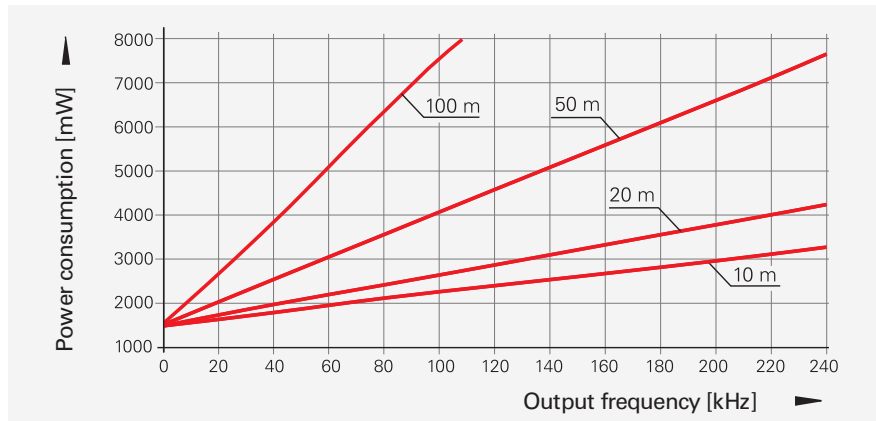
$$f = (n/60) \times z \times 10^{-3}$$

where

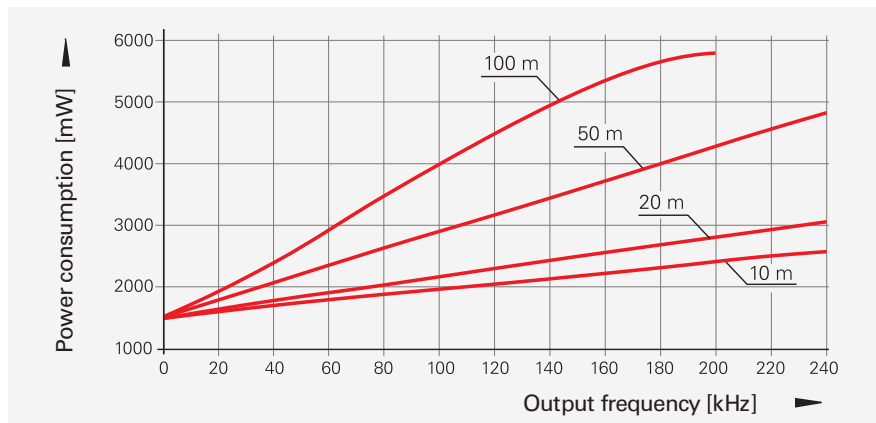
f = Output frequency in kHz

n = Shaft speed in min<sup>-1</sup>

z = Number of signal periods per 360°



Power consumption (maximum) for HTL interface and supply voltage  $U_P = 30\text{ V}$



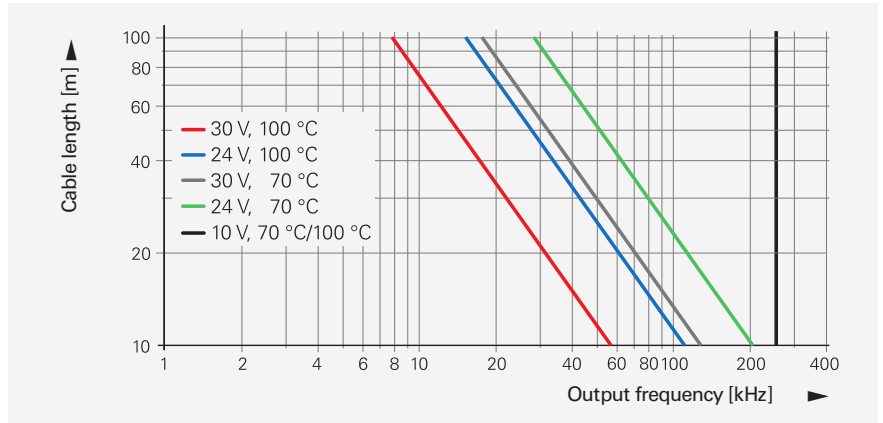
Power consumption (maximum) for HTLs interface and supply voltage  $U_P = 30\text{ V}$

## Cable length for HTL

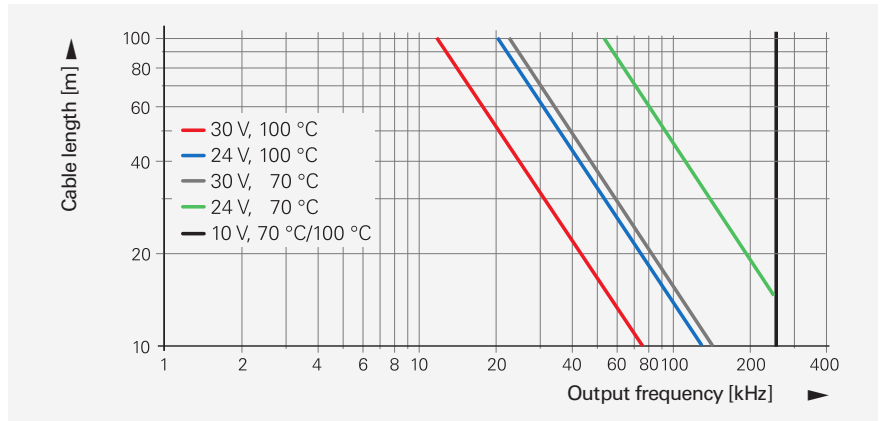
For the rotary encoders with additional HTL output signals, the maximum permissible cable length depends on several criteria:

- Output frequency
- Supply voltage
- Operating temperature

The correlations are shown separately for the HTL and HTLs interface in the diagrams. There are no limitations if a supply voltage of 10 V DC is used.








Maximum permissible cable length for HTL interface



Maximum permissible cable length for HTLs interface

# Electrical connection

## Pin layout for EnDat with TTL or HTL






17-pin flange socket, M23													
													
	Power supply					Incremental signals				Absolute position values			
	7	1	10	4	11	15	16	12	13	14	17	8	9
	$U_p$	Sensor $U_p$	0 V	Sensor 0 V	Internal shield	$U_{a1}$	$\overline{U_{a1}}$	$U_{a2}$	$\overline{U_{a2}}$	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$
	Brown/ Green	Blue	White/ Green	White	/	Green/ Black	Yellow/ Black	Blue/ Black	Red/ Black	Gray	Pink	Violet	Yellow

**Cable shield** connected to housing; **Up** = power supply

**Sensor:** The sensor line is connected inside the encoder to the respective power line

Vacant pins or wires must not be used!

## Pin layout for SSI with TTL

17-pin flange socket, M23															
															
	Power supply					Incremental signals				Absolute position values				Others	
	7	1	10	4	11	15	16	12	13	14	17	8	9	2	5
<b>SSI with TTL</b>	$U_p$	Sensor $U_p$	0 V	Sensor 0 V	Internal shield	$U_{a1}$	$\overline{U_{a1}}$	$U_{a2}$	$\overline{U_{a2}}$	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$	Direction of rotation <sup>1)</sup>	Zero reset <sup>1)</sup>
	Brown/ Green	Blue	White/ Green	White	/	Green/ Black	Yellow/ Black	Blue/ Black	Red/ Black	Gray	Pink	Violet	Yellow	Black	Green




1) See Interfaces of HEIDENHAIN Encoders catalog

**Cable shield** connected to housing; **Up** = power supply

**Sensor:** The sensor line is connected inside the encoder to the respective power line

Vacant pins or wires must not be used!

## Pin layout for SSI with HTL




12-pin flange socket, M23												
	Power supply		Incremental signals				Absolute position values				Others	
	1	2	11	10	12	8	4	6	3	7	9	5
SSI with HTL	U <sub>p</sub>	0 V	U <sub>a1</sub>	U <sub>a1</sub>	U <sub>a2</sub>	U <sub>a2</sub>	DATA	DATA	CLOCK	CLOCK	Direction of rotation <sup>1)</sup>	Zero reset <sup>1)</sup>
	Brown/ Green	White/ Green	Green/ Black	Yellow/ Black	Blue/ Black	Red/ Black	Gray	Pink	Violet	Yellow	Black	Green

1) See Interfaces of HEIDENHAIN Encoders catalog

**Cable shield** connected to housing; **U<sub>p</sub>** = power supply

**Sensor:** The sensor line is connected inside the encoder to the respective power line  
Vacant pins or wires must not be used!

## Pin layout for SSI with HTLs

12-pin flange socket, M23												
	Power supply		Incremental signals			Absolute position values				Others		
	1	10	2	8	9	4	6	3	7	11	5	12
SSI with HTLs	U <sub>p</sub>	U <sub>p</sub>	0 V	U <sub>a1</sub>	U <sub>a2</sub>	DATA	DATA	CLOCK	CLOCK	Direction of rotation <sup>1)</sup>	Zero reset <sup>1)</sup>	/
	Brown/ Green	Blue	White/ Green	Green/ Black	Blue/ Black	Gray	Pink	Violet	Yellow	Black	Green	/

1) See Interfaces of HEIDENHAIN Encoders catalog




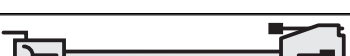
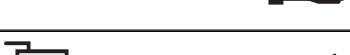

**Cable shield** connected to housing; **U<sub>p</sub>** = power supply

**Sensor:** The sensor line is connected inside the encoder to the respective power line  
Vacant pins or wires must not be used!








# Electrical connection

## Cables for rotary encoder with 12-pin flange socket

<b>PUR connecting cable</b> Ø 8 mm; [4(2×0.14 mm <sup>2</sup> ) + (4×0.5 mm <sup>2</sup> ); A <sub>P</sub> = 0.5 mm <sup>2</sup>		
<b>Complete</b> with M23 connector (female) and M23 coupling (male), both 12 pins		ID 298401-xx
<b>Complete</b> with M23 connector (female) and M23 connector (male), both 12 pins		ID 298399-xx
<b>Complete</b> with M23 connector (female), 12-pin and D-sub connector (female), 15-pin		ID 310199-xx
<b>Complete</b> with M23 connector (female), 12-pin and D-sub connector (male), 15-pin		ID 310196-xx
<b>With one connector</b> M23 (female), 12-pin		ID 309777-xx
<b>Cable without connectors</b> , Ø 8 mm		ID 816317-xx

## Cables for rotary encoder with 17-pin flange socket

<b>PUR connecting cable</b> Ø 8 mm; [(4×0.14 mm <sup>2</sup> ) + 4(2×0.14 mm <sup>2</sup> ) + (4×0.5 mm <sup>2</sup> ); A <sub>P</sub> = 0.5 mm <sup>2</sup>		
<b>Complete</b> with M23 connector (female) and M23 coupling (male), both 17 pins		ID 323897-xx
<b>Complete</b> with M23 connector (female), 17-pin and D-sub connector (female), 15-pin		ID 332115-xx
<b>Complete</b> with M23 connector (female), 17-pin and D-sub connector (male), 15-pin		ID 324544-xx
<b>With one connector</b> M23 (female), 17-pin		ID 309778-xx
<b>Cable without connectors</b> , Ø 8 mm		ID 816322-xx

# 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 valid when the contract is made.

### Related documents:

For general mechanical and electrical information as well as the detailed interface description, please see:

- *Encoders for Servo Drives* catalog
- *Rotary Encoders* catalog
- *Interfaces of HEIDENHAIN Encoders* catalog