Linear Encoders

Angle Encoders

Rotary Encoders

3-D Touch Probes

Position Display Units

Numerical Controls

New Versions of Rotary Encoders for Integration in Servo Drives – ECN/EQN/ERN 1300 Series

For some time now the absolute and incremental encoders of the ECN/EQN/ERN 1300 series have been used with great success in spindle and servo drives in automation technology and machine construction. ERN 1321/1381 incremental encoders as well as ECN 1313/1325 singleturn absolute rotary encoders are used on sealed asynchronous motors, where their exact measurement of the shaft speed contributes to the high productivity of the facilities. Along with the ERN 1387 incremental rotary encoders (with Z1 track), most often the ECN/EQN absolute singleturn and multiturn encoders are used in synchronous servo motors. They guarantee both high positioning accuracy and low speed ripple.

Fundamental revisions have improved this successful series from HEIDENHAIN. The resulting advantages directly influence the performance and application possibilities of motors equipped with these encoders. The **increased acceleration load capacity** permits the motors to be used on facilities with extremely high shock and vibration loads.
Their **reduced size** makes smaller motors possible, and therefore more compact facilities and machines. Thanks to their **uniform dimensions,** incremental and absolute rotary encoders can be integrated into the same motor housing, without any space problems. The **simplified connection technology** also leads to a reduction in costs: The encoder variants with the EnDat 2.2 purely serial interface only need 8-wire, single-shielded cables and small M12 connectors. These EnDat 2.2 encoders also feature **integrated signal interpolation** and calculation of the position value. This reduces the real-time processing capacity required by the subsequent electronics. Another advantage is the **integrated temperature evaluation.** The connector plugs and cables between the temperature sensor and subsequent electronics can therefore be omitted. Along with the temperature value, **expanded diagnostic information** is now also transmitted via the serial interface.

ECN/EQN/ERN 1300 Series

Rotary Encoders with Integral Bearings for Integration in Motors
• **Mounted stator coupling Ø 64.8 mm**
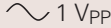• **Taper shaft**
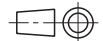
Dimensions in mm

Tolerancing ISO 8015
ISO 2768 - m H
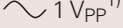
Ⓐ = Bearing of mating shaft
Ⓑ = Bearing of encoder
Ⓚ = Required mating dimensions
Ⓜ = Measuring point for operating temperature
Ⓗ1 = Clamping screw for coupling ring – SW2
Tightening torque 1.23 Nm
Ⓗ2 = ERN/ECN/EQN plug connector, 12 pins
ERN with Z1 track, plug connector, 12 pins
ERN with block commutation, plug connector, 16 pins
Ⓗ3 = Screw plug SW3 and SW4
Ⓗ4 = Die-cast cover
Ⓗ5 = Self-tightening screw M5 x 50 DIN 6912 SW4
Tightening torque 5 Nm
Ⓗ6 = Back-off thread M10

	Absolute			
	ECN 1313	**ECN 1325**	**EQN 1325**	**EQN 1337**
Incremental signals	$\sim$ 1 V$_{PP}$[1]	–	$\sim$ 1 V$_{PP}$[1]	–
Line count*/ System accuracy	512/± 60″ [2] 2048/± 20″	–	512/± 60″ [2] 2048/± 20″	–
Reference mark	–			
Scanning frequency Edge separation *a* Cutoff frequency –3dB	– – 2048 lines: ≥ 200 kHz 512 lines: ≥ 100 kHz	–	– – 2048 lines: ≥ 200 kHz 512 lines: ≥ 100 kHz	–
Absolute position values	EnDat 02 instruction set 2.2 with analog signals	EnDat 2.2 instruction set 2.2 without analog signals	EnDat 02 instruction set 2.2 with analog signals	EnDat 2.2 instruction set 2.2 without analog signals
Position values per rev.	8192 (13 bits)	33 554 432 (25 bits)	8192 (13 bits)	33 554 432 (25 bits)
Distinguishable revolutions	–		4096 (12 bits)	
Elec. perm. speed/ System accuracy 512 lines: 2048 lines:	5000 rpm/± 1 LSB 12 000 rpm/± 100 LSB 1 500 rpm/± 1 LSB 12 000 rpm/± 50 LSB	– 100 rpm/± 1 LSB 12 000 rpm/± 24 LSB	5000 rpm/± 1 LSB 12 000 rpm/± 100 LSB 1 500 rpm/± 1 LSB 12 000 rpm/± 50 LSB	– 100 rpm/± 1 LSB 12 000 rpm/± 24 LSB
Power supply	5 V ± 5%	3.6 to 5.25 V at the encoder	5 V ± 5%	3.6 to 5.25 V at the encoder
Current consumption (without load)	≤ 150 mA		≤ 250 mA	≤ 200 mA
Elec. connection via PCB connector	12-pin	*Rotary encoder:* 12-pin *Temp. sensor:* 4-pin	12-pin	*Rotary encoder:* 12-pin *Temp. sensor:* 4-pin
Max. cable length	150 m (492 ft)	100 m (329 ft)	150 m (492 ft)	100 m (329 ft)
Shaft	Taper shaft ∅ 9.25 mm; taper 1:10			
Mechanically permissible speed	≤ 15 000 rpm		≤ 12 000 rpm	
Starting torque at 20 °C (68 °F)	≤ 0.01 Nm			
Moment of inertia of rotor	2.6 x 10^{-6} kgm^2			
Natural freq. of the stator coupling	≥ 1800 Hz			
Perm. axial motion of measured shaft	± 0.5 mm			
Vibration 55 to 2000 Hz **Shock** 6 ms	≤ 300 m/s^2 (IEC 60 068-2-6) ≤ 2000 m/s^2 (IEC 60 068-2-27)		≤ 150 m/s^2 (IEC 60 068-2-6) ≤ 2000 m/s^2 (IEC 60 068-2-27)	
Max. operating temperature	115 °C (239 °F)			
Min. operating temperature	–30 °C (–22 °F)			
Protection IEC 60 529	IP 40 when mounted			
Weight	Approx. 0.25 kg (8.8 oz)			

* Please indicate when ordering
[1] Limited tolerances: see the *Position Encoders for Servo Drives* brochure
[2] Delivery starting in mid-2005

Incremental			
ERN 1321	**ERN 1381**	**ERN 1387**	**ERN 1326** [2]
⊓⊔ TTL	∿ 1 V_PP [1]		⊓⊔ TTL
1024/±64″ 2048/± 32″ 4096/±16″	512/±60″ 2048/± 20″ 4096/±16″	2048/± 20″	1024/±64″ 2048/± 32″ 4096/±16″
One			
≤ 300 kHz ≥ 0.43 µs	≥ 200 kHz		≤ 300 kHz ≥ 0.43 µs
–		∿ 1 V_PP	⊓⊔ TTL
–		Z1 track [3]	3 x ⊓⊔ TTL [4]
–			
–			
5 V ± 5%			
≤ 120 mA		≤ 150 mA	
12-pin			
100 m (329 ft)	150 m (492 ft)		100 m (329 ft)
Taper shaft ⌀ 9.25 mm; taper 1:10			
≤ 15000 rpm			
≤ 0.01 Nm			
2.6×10^{-6} kgm^2			
≥ 1800 Hz			
± 0.5 mm			
≤ 300 m/s^2 (IEC 60068-2-6) ≤ 2000 m/s^2 (IEC 60068-2-27)			
120 °C (248 °F); *4096 lines:* 80 °C (176 °F)		120 °C (248 °F)	120 °C; *4096 lines:* 80 °C (176 °F)
–30 °C (–22 °F)			
IP 40 when mounted			
Approx. 0.25 kg (8.8 oz)			

[3] For sine commutation: One sine and one cosine signal per revolution
[4] For block commutation: Three block commutation tracks with 90° or 120° mech. phase shift

Electrical Connection

For ECN 1313, EQN 1325 and ERN: see the *Position Encoders for Servo Drives* brochure
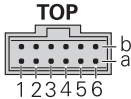**For ECN 1325, EQN 1337:**

Encoder cable inside the motor housing
Cable Ø 4.5 mm 16 x AWG 30/7
Crimp sleeve Ø 6 mm

|		
With one connector with 12-pin PCB connector		332 202-xx
Complete with PCB connector, 12-pin and 4-pin and right-angle socket M12, 8-pin for purely serial data transmission	M12	530 094-01

Encoder cable

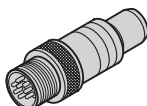|		
Complete with M12 connector (female), 8-pin and M12 coupling (male), 8-pin for purely serial data transmission	M12 M12	368 330-xx
Complete with 12-pin PCB connector and D-sub connector (male) for IK 115 / IK 215		524 599-xx

Pin Layout

12-pin PCB connector

TOP
b
a
1 2 3 4 5 6

	Power supply				Incremental signals[1]				Absolute position values			
	1b	**6a**	**4b**	**3a**	**2a**	**5b**	**4a**	**3b**	**6b**	**1a**	**2b**	**5a**
	U_P	Sensor U_P	**0 V**	Sensor 0 V	**Vacant**[1]	**Vacant**[1]	**Vacant**[1]	**Vacant**[1]	**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

Shield on housing; U_P = Power supply voltage.
Sensor: The sensor line is connected internally with the corresponding power line.
Vacant pins or wires must not be used!
[1] Used only on encoders with incremental signals

4-pin PCB connector

TOP
b
a
1 2

	Other signals			
	1a	**1b**	**2a**	**2b**
	T+	**T–**	**–**	**–**
	Brown	Green	Vacant	Vacant

T = Temperature sensor

Pin Layout

8-pin M12 coupling							

M12

	Power supply				Absolute position values			
▣	**2**	**8**	**1**	**5**	**3**	**4**	**7**	**6**
	U_P	U_P	0 V	0 V	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$

HEIDENHAIN measuring equipment

The **IK 215** is an adapter card for PCs for inspecting and testing absolute HEIDENHAIN encoders with EnDat or SSI interface. Parameters can be read and written via the EnDat interface.

	IK 215	
Encoder input	EnDat (absolute value or incremental signals) or SSI	
Interface	PCI bus, Rev 2.1	
Application software	**Operating system:**	Windows 98/2000/XP
	Features:	Display of position value
		Counter for incremental signals
		EnDat functionality
Signal subdivision for incremental signals	Up to 1024-fold	
Dimensions	100 mm x 190 mm	

HEIDENHAIN

For more information
• *Position Encoders for Servo Drives* brochure