

Incremental encoders

Large hollow shaft robust, optical	A02H (hollow shaft)	Push-Pull / RS422 / SinCos
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The Heavy Duty incremental encoder type A02H boasts a high degree of ruggedness in a very compact design. Its special construction makes it perfect for all applications in very harsh environments. **24one delivery promise.**



24one
10 days max.



High rotational speed



High protection level



High shaft load capacity



Shock / vibration resistant



Magnetic field proof



Optical sensor

Heavy Duty - robust

- Special shaft connection with interlocked bearings.
- Balanced stainless steel clamping ring.
- Optional isolation inserts available to protect against shaft currents.

Compact and versatile

- Only 49 mm installation depth.
- With cable connections, M12, M23, Sub-D or MIL connectors.
- With Push-Pull, RS422 or SinCos interface.

Order code Hollow shaft

8.A02H.XXX.XXX.XXX.PXX.XX
Type a b c d e f g h

We offer for all encoders configured with the **underlined preferential options** our free of charge **24one** delivery promise.

24one
10 days max.

Orders placed on working days before 9AM CET are manufactured and ready for dispatch the same day and within 10 days in overseas. The **24one** delivery promise is limited to 20 pieces per order.

a Flange

- 1 = without mounting aid**
- 2 = with spring element, short**
- 3 = with spring element, long**
- 5 = with fastening arm, long**
- 6 = with fastening arm, short, 4.5"**

b Hollow shaft

- C = ø 20 mm [0.79"]**
- 6 = ø 24 mm [0.94"]**
- 5 = ø 25 mm [0.98"]**
- 3 = ø 28 mm [1.10"]**
- A = ø 30 mm [1.18"]**
- H = ø 35 mm [1.38"]** ¹⁾
- 2 = ø 38 mm [1.50"]** ¹⁾
- B = ø 40 mm [1.57"]** ¹⁾
- 1 = ø 42 mm [1.65"]** ¹⁾
- D = ø 1/2"**
- E = ø 5/8"**
- F = ø 3/4"**
- 4 = ø 1"**
- G = ø 1 1/8"**
- N = ø 1 1/4"**

c Output circuit (with inverted signal) / power supply

- 1 = RS422 / 5 V DC
- D = RS422 / 5 ... 30 V DC**
- 4 = RS422 / 10 ... 30 V DC
- 5 = Push-pull / 5 ... 30 V DC**
- 3 = Push-pull / 10 ... 30 V DC
- 8 = SinCos, 1 Vpp / 5 V DC
- 9 = SinCos, 1 Vpp / 10 ... 30 V DC
- A = Push-pull (7272 compatible) / 5 ... 30 V DC**

d Type of connection

- 1 = radial cable, 1 m [3.28"] PVC**
- A = radial cable, special length PVC *)
- 2 = radial M23 connector, 12-pin**
- E = radial M12 connector, 8-pin**
- R = radial M12 connector, 5-pin ⁴⁾
- G = Sub-D connector, male contact, 9-pin, double-row ²⁾
- K = MIL connector, 7-pin ¹⁾⁴⁾
- D = MIL connector, 10-pin**

*) Available special lengths (connection type A):
2, 3, 5, 8, 10, 15 m [6.56, 9.84, 16.40, 26.25, 32.80, 49.21']
order code expansion .XXXX = length in dm
ex.: 8.A02H.111A.2048.0030 (for cable length 3 m)

e Pulse rate

- 50, 360, 512, 600, 1000, 1024, 1500, 2000, 2048, 2500, 4096, 5000**
- (e.g. 360 pulses => 0360)

SinCos version only available with pulses ≥ 1024

f Special output signal formats

- 00 = standard output**
- other = see page 6**

g Special insert options

- A = isolation insert not included
- B = isolation insert included**

h Special connector pin configuration

- 0 = standard wiring**
- other = see page 5**

Optional on request

- other pulse rates on request
- Ex 2/22 ³⁾


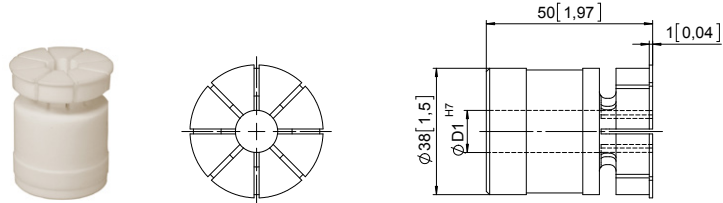
1) Not available with isolation insert.

2) Protection level IP40.

3) For the cable connection type, cable material PUR.

4) Without inversion, cannot be combined with SinCos.

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Mounting accessory for hollow shaft encoders			Order no.	
Tapered shaft mounting kit for A02H with hollow shaft, \varnothing 38 mm [1.50"]			For use in upgrading for tapered shaft mounting. Tapered shafts are used for high-precision direct coupling. An isolation insert is also included in the mounting kit; this reliably protects the encoder from shaft currents. Included in the set: <ul style="list-style-type: none"> • Insert for cone blind hole, cone 1:10, 17 mm [0.67"] length • Isolation insert • Allen screw for central fixing 	8.0010.4028.0000
Isolation insert for hollow shaft, \varnothing 38 mm [1.50"] Temperature range -40°C ... +115°C [-40°F ... +239°F]			\varnothing D1: 12 mm [0.47"] 14 mm [0.55"] 15 mm [0.59"] 16 mm [0.63"] 18 mm [0.71"] 20 mm [0.79"] 25 mm [0.98"] 30 mm [1.18"] 32 mm [1.26"] 1/2" 5/8" 3/4" 1" 1 1/4"	8.0010.4091.0000 8.0010.4027.0000 8.0010.4038.0000 8.0010.4019.0000 8.0010.4080.0000 8.0010.4011.0000 8.0010.4012.0000 8.0010.4016.0000 8.0010.4015.0000 8.0010.4013.0000 8.0010.4070.0000 8.0010.4090.0000 8.0010.4050.0000 8.0010.4060.0000
Isolation inserts prevent currents from passing through the encoder bearings. These currents can occur when using inverter controlled three-phase or AC motor motors and considerably shorten the service life of the encoder bearings. For more details please call our technical hotline (+49 7720 3903 92) or send us an email (info@kuebler.com)		Isolation insert for hollow shaft, \varnothing 42 mm [1.65"] external diameter 42 mm [1.65"] / internal diameter 38 mm [1.50"] external diameter 42 mm [1.65"] / internal diameter 12 mm [0.47"]	8.0010.4017.0000 8.0010.4029.0000	

Additional connectors can be found in the connection technology section or in the connection technology area of our website at: www.kuebler.com/connection_technology.

Incremental encoders

Large hollow shaft robust, optical	A02H (hollow shaft)	Push-Pull / RS422 / SinCos
Connection technology		Order no.
Cordset, pre-assembled	M12 female connector with coupling nut, 8-pin, A coded, straight single-ended 2 m [6.56'] PVC cable	05.00.6041.8211.002M
	M23 female connector with coupling nut, 12-pin, cw single-ended 2 m [6.56'] PVC cable	8.0000.6201.0002
Connector, self-assembly	M12 female connector with coupling nut, 8-pin, A coded, straight (metal)	05.CMB 8181-0
	M12 female connector with coupling nut, 8-pin, A coded, straight (stainless steel V4A)	8.0000.5136.0000.V4A
	M23 female connector with coupling nut, 12-pin, cw (metal)	8.0000.5012.0000

Additional connectors can be found in the connection technology section or in the connection technology area of our website at: kuebler.com/connection_technology.

Technical data

Mechanical characteristics		Electrical characteristics SinCos output		
Maximum speed	6000 min ⁻¹ 1) at 60°C [140°F] 2500 min ⁻¹ 1)	Output circuit	SinCos U = 1 Vpp	SinCos U = 1 Vpp
Mass moment of inertia	< 220 x 10 ⁻⁶ kgm ² 2)	Power supply	5 V DC (±5 %)	10 ... 30 V DC
Starting torque with sealing	< 0.2 Nm, at 20°C [68°F]	Power consumption (no load)	typ. 65 mA max. 110 mA	typ. 65 mA max. 110 mA
Load capacity of shaft	radial: 200 N axial: 100 N	-3 dB frequency	< 180 kHz	< 180 kHz
Weight	approx. 0.8 kg [28.22 oz]	Signal level	channels A/B 1 Vpp (±20 %) channel 0 0.1 ... 1.2 V	1 Vpp (±20 %) 0.1 ... 1.2 V
Protection acc. to EN 60529	IP65	Short circuit proof outputs 4)	yes	yes
Working temperature range	-40°C 3) ... +80°C [-40°F 3) ... +176°F]	Reverse polarity protection of the power supply	no	yes
Materials	shaft stainless steel, bore tolerance H7	UL approval	file 224618	
Shock resistance acc. to EN 60068-2-27	2000 m/s ² , 6 ms	GL approval	letter of conformity No. 74130	
Vibration resistance acc. to EN 60068-2-6	100 m/s ² , 10 ... 2000 Hz	CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU	

Electrical characteristics RS422 / Push-Pull				
Output circuit	RS422 (TTL compatible)	Push-Pull	Push-Pull (7272 compatible)	
Power supply	5 V DC (±5 %) 5 ... 30 V DC 10 ... 30 V DC	5 ... 30 V DC 10 ... 30 V DC	5 ... 30 V DC	
Power consumption (no load)	without inverted signal – with inverted signal typ. 40 mA/max. 90 mA	typ. 55 mA/max. 125 mA typ. 80 mA/max. 150 mA	– typ. 50 mA/max. 100 mA	
Permissible load / channel	max. +/- 20 mA	max. +/- 30 mA	max. +/- 20 mA	
Pulse frequency	max. 300 kHz	max. 300 kHz	max. 300 kHz 5)	
Signal level	HIGH min. 2.5 V LOW max. 0.5 V	min. +V – 3 V max. 2.5 V	min. +V - 2.0 V max. 0.5 V	
Rising edge time t_r	max. 200 ns	max. 1 μs	max. 1 μs	
Falling edge time t_f	max. 200 ns	max. 1 μs	max. 1 μs	
Short circuit proof outputs 4)	yes	yes	yes	
Reverse polarity protection of the power supply	no, 10 ... 30 V DC: yes	yes	no	
UL approval	file 224618			
GL approval	letter of conformity No. 74130			
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU			

1) During the run-in-phase of approx. 2 hours, reduce the limits for working temperature_{max} or speed max by 1/3.

2) Depending on shaft diameter.

3) With connector: -40°C [-40°F], securely installed: -30°C [-22°F], flexibly installed: -20°C [-4°F].

4) If power supply correctly applied.

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5) Max. recommended cable length 30 m [98.43'].

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Terminal assignment – Standard wiring

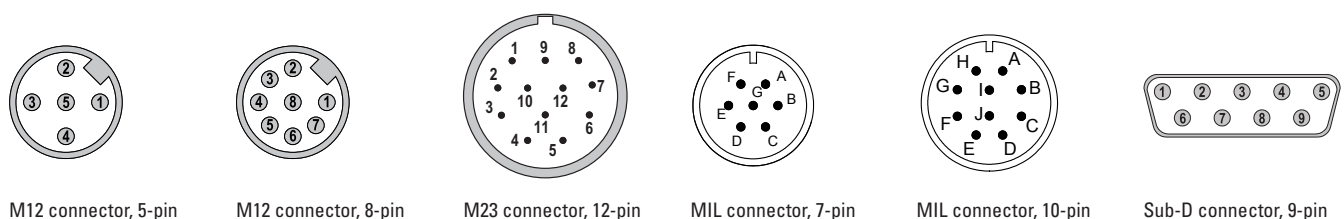
Output circuit	Type of connection	Cable (isolate unused cores individually before initial start-up)											
1 ... D	1, A	Signal:	0 V	+V	0 Vsens	+Vsens	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp
		Core color:	WH	BN	GY/PK	RD/BU	GN	YE	GY	PK	BU	RD	shield
		M23 connector, 12-pin											
1 ... D	2	Signal:	0 V	+V	0 Vsens	+Vsens	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp
		Pin:	10	12	11	2	5	6	8	1	3	4	PH ¹⁾
		M12 connector, 8-pin											
1 ... D	E	Signal:	0 V	+V	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp		
		Pin:	1	2	3	4	5	6	7	8	PH ¹⁾		
		M12 connector, 5-pin											
1 ... D	R	Signal:	0 V	+V	A	B	0	\perp					
		Pin:	1	2	3	4	5	PH ¹⁾					
		MIL connector, 10-pin											
1 ... D	D	Signal:	0 V	+V	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp		
		Pin:	F	D	A	G	B	H	C	I	J		
		MIL connector, 7-pin											
1 ... D	K	Signal:	0 V	+V	+Vsens	A	B	0	\perp				
		Pin:	F	D	E	A	B	C	J				
		Sub-D connector, 9-pin											
1 ... D	G	Signal:	0 V	+V	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp		
		Pin:	1	2	3	6	4	7	5	8	PH ¹⁾		

Terminal assignment – Special connector pin configuration

Order code ^{h)}	Output circuit	Type of connection	M12 connector, 8-pin											
7	1 ... D	E	Signal:	0 V	+V	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp		
			Pin:	7	2	1	3	4	5	6	8	PH ¹⁾		
Order code ^{h)}	Output circuit	Type of connection	MIL connector, 10-pin											
6	1 ... D	D	Signal:	0 V	+V	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp		
			Pin:	F	D	A	H	B	I	C	J	G		

- +V: Encoder power supply +V DC
- 0 V: Encoder power supply ground GND (0 V)
- 0 Vsens / +Vsens: Using the sensor outputs of the encoder, the voltage present can be measured and if necessary increased accordingly.
- A, \bar{A} : Incremental output channel A
- B, \bar{B} : Incremental output channel B
- 0, $\bar{0}$: Reference signal
- PH \perp : Plug connector housing (shield)

Top view of mating side, male contact base



1) PH = shield is attached to connector housing.

Incremental encoders

**Large hollow shaft
robust, optical**

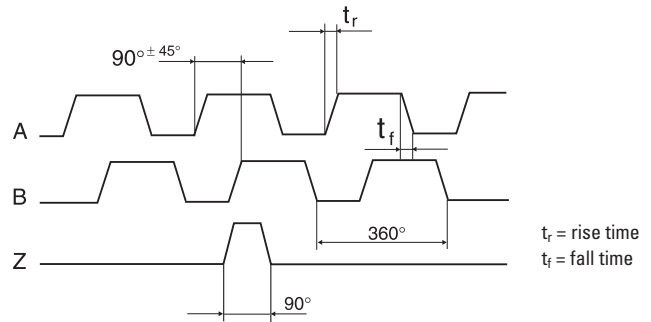
A02H (hollow shaft)

Push-Pull / RS422 / SinCos

Special output signal formats

All Kübler encoders come standard with six channels where A leads B in the clockwise direction and the standard index is gated with A & B. The tolerance of the wave form affects the control and, in some cases, may affect the smoothness of system operation.

Wave form tolerances



A leads B when the shaft is rotated in the clockwise direction viewing the shaft or collet end. This is the Kübler standard. This format applies to the pin key codes listed below.		A \bar{A} B \bar{B}
Order code i		
	Z gated with A & B. This is the Kübler standard. Z is 90° wide.	Z \bar{Z}
01	Z gated with B. Z is 180° wide.	Z \bar{Z}
02	Z gated with A. Z is 180° wide.	Z \bar{Z}
03	Z ungated. Z is 330° to 360° wide.	Z \bar{Z}
08	Z is 180° wide	Z \bar{Z}
11	Z is a minimum width of 270° (electrical degrees).	Z \bar{Z}
13	Z gated with \bar{B} . Z is 180° wide.	Z \bar{Z}

B leads A when the shaft is rotated in the clockwise direction viewing the shaft or collet end. This format applies to the pin key codes listed below.		A \bar{A} B \bar{B}
Order code i		
04	Z gated with A & B. Z is 90° wide.	Z \bar{Z}
05	Z gated with B. Z is 180° wide.	Z \bar{Z}
06	Z gated with A. Z is 180° wide.	Z \bar{Z}
07	Z ungated. Z is 330° to 360° wide.	Z \bar{Z}
09	Z gated with \bar{B} . Z is 180° wide.	Z \bar{Z}
10	Z is a negative marker gated with B. Z is 180° wide.	Z \bar{Z}
12	Z has a minimum width of 270°.	Z \bar{Z}

Incremental encoders

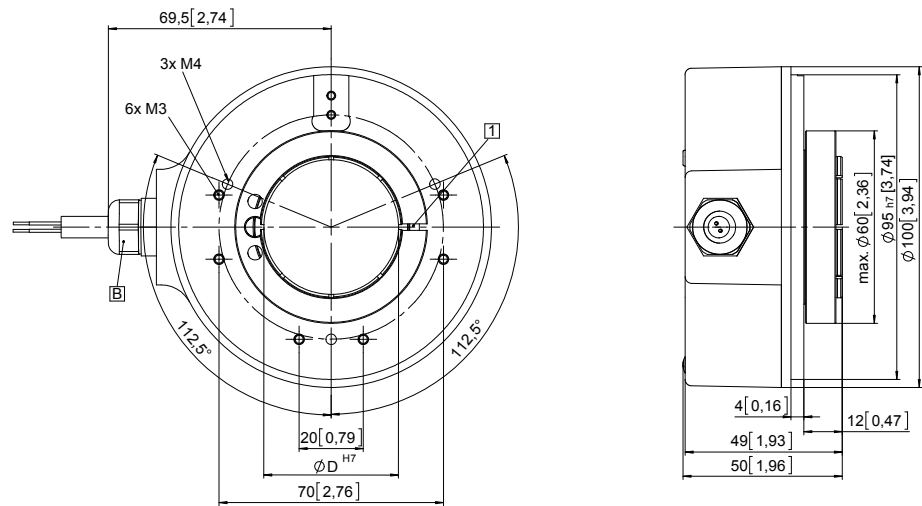
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Dimensions hollow shaft version

Dimensions in mm [inch]

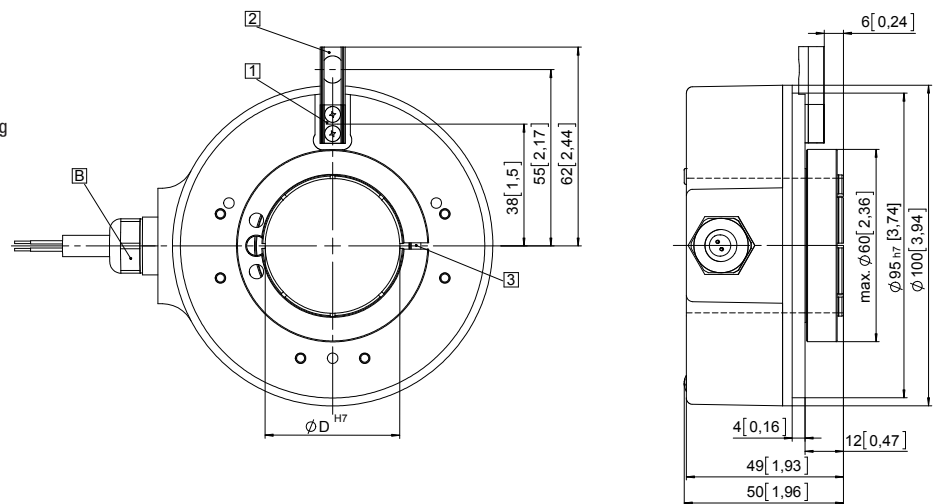
Flange without mounting aid Flange type 1

- 1 Recommended torque for the clamping ring 1.0 Nm
- B Cable version



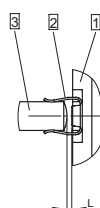
Flange with spring element Flange type 2 and 3

- 1 Spring element, short (flange type 2)
- 2 Spring element, long (flange type 3)
- 3 Recommended torque for the clamping ring
flange type 2: 1.0 Nm
flange type 3: 2.0 Nm
- B Cable version



Mounting using the spring element, short

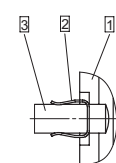
When mounting the encoder, ensure that dimension L is larger than the maximum axial play of the drive in the direction of the arrow.
Danger of mechanical seizure!



- 1 Flange
- 2 Spring element, short
- 3 Cylindrical pin

Mounting using the spring element, long

Cylindrical pin fed through the bore of the spring



- 1 Flange
- 2 Spring element, long
- 3 Cylindrical pin

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A02H (hollow shaft)

Push-Pull / RS422 / SinCos

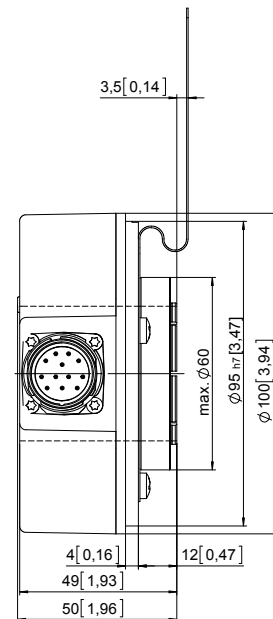
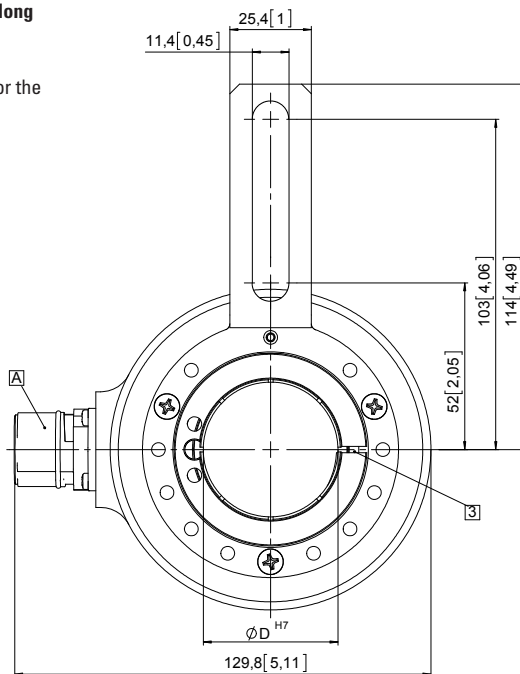
Dimensions hollow shaft version

Dimensions in mm [inch]

**Flange with fastening arm, long
Flange type 5**

3 Recommended torque for the
clamping ring 2.0 Nm

A Plug version



**Flange with fastening arm, short 4.5"
Flange type 6**

3 Recommended torque for the
clamping ring 2.0 Nm

A Plug version

