

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.



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.XXXX.XXXX
Type a b c d e

a Flange

- 1 = without mounting aid
 - 2 = with spring element, short
 - 3 = with spring element, long
 - 5 = with torque stop, long
-
- 6 = with torque stop, short, 4.5" ¹⁾

b Through hollow shaft

- C = \varnothing 20 mm [0.79"]
- 6 = \varnothing 24 mm [0.94"]
- 5 = \varnothing 25 mm [0.98"]
- 3 = \varnothing 28 mm [1.10"]
- A = \varnothing 30 mm [1.18"]
- H = \varnothing 35 mm [1.38"]
- 2 = \varnothing 38 mm [1.50"]
- B = \varnothing 40 mm [1.57"]
- 1 = \varnothing 42 mm [1.65"]
- 4 = \varnothing 1"

- D = \varnothing 1/2" ¹⁾
- E = \varnothing 5/8" ¹⁾
- F = \varnothing 3/4" ¹⁾
- G = \varnothing 1 1/8" ¹⁾
- N = \varnothing 1 1/4" ¹⁾

c Output circuit (with inverted signal) / power supply

- 1 = RS422 / 5 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 = RS422 / 5 ... 30 V DC ¹⁾

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
 - G = Sub-D connector, male contact, 9-pin, double-row ²⁾
 - R = radial M12 connector, 5-pin ⁴⁾
-
- K = MIL connector, 7-pin ¹⁾⁴⁾
 - D = MIL connector, 10-pin ¹⁾

*) 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 \geq 1024

Optional on request

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

1) US version.
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	Dimensions in mm [inch]	Order no.
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Cylindrical pin, long
for flange with spring element
(flange type 2 + 3)

with fixing thread

8.0010.4700.0003

Tether arm, flexible

70 mm [2.76"]
100 mm [3.94"]
150 mm [5.91"]

8.0010.40S0.0000
8.0010.40T0.0000
8.0010.40U0.0000

Tether arm	L1	L2
70 mm [2.76"]	64 ... 74 [2.51 ... 2.91]	82 ... 92 [3.23 ... 3.62]
100 mm [3.94"]	94 ... 104 [3.70 ... 4.09]	112 ... 122 [4.41 ... 4.80]
150 mm [5.91"]	144 ... 154 [5.67 ... 6.06]	162 ... 172 [6.38 ... 6.77]

1 Socket screw M2.5 x 6 [0.24]
 2 Lock washer

Torque stop, short



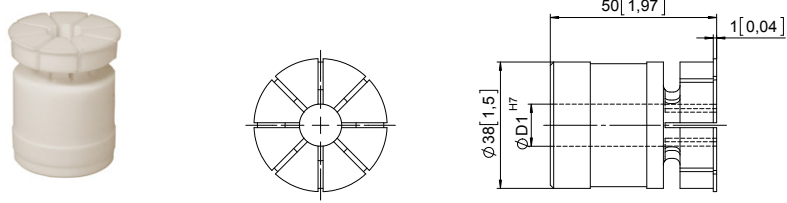
8.0010.4T00.0000

1 Curved spring element
 2 Hexagonal nut 3/8 - 16 UNC
 3 Washer (isolating)
 4 Hexagonal screw 3/8 16 UNC x 1"
 5 Washer D10.4 x 15 x 15

Stator coupling

8.0010.40V0.0000

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Mounting accessory for hollow shaft encoders		Order no.																												
<p>Protective cover</p> 	<p>For applications with a very high degree of pollution, Kübler now offers a protective cover for</p> <ul style="list-style-type: none"> • Improved reliability • Extension of the service life of the encoder <p>Scope of delivery:</p> <ul style="list-style-type: none"> • Protective cover • Torque stop (8.0010.4T00.0000) • 3 screws for fixing to the encoder 	<p>8.0010.40Y0.0001</p>																												
<p>Tapered shaft mounting kit for A02H with hollow shaft, \varnothing 38 mm [1.50"]</p> 	<p>For use in upgrading for tapered shaft mounting. Tapered shafts are used for high-precision direct coupling.</p> <p>An isolation insert is also included in the mounting kit; this reliably protects the encoder from shaft currents.</p> <p>Included in the set:</p> <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 	<p>8.0010.4028.0000</p>																												
<p>Isolation insert for hollow shaft, \varnothing 38 mm [1.50"] Temperature range -40°C ... +115°C [-40°F ... +239°F]</p>  <p>Isolation inserts prevent currents from passing through the encoder bearings. These currents can occur when using inverter controlled three-phase or AC vector motors and considerably shorten the service life of the encoder bearings. For more details please call our technical hotline (+49 7720 3903 952) or send us an email (info@kuebler.com)</p>	<p>\varnothing D1:</p> <table border="0"> <tr><td>12 mm [0.47"]</td><td>8.0010.4091.0000</td></tr> <tr><td>14 mm [0.55"]</td><td>8.0010.4027.0000</td></tr> <tr><td>15 mm [0.59"]</td><td>8.0010.4038.0000</td></tr> <tr><td>16 mm [0.63"]</td><td>8.0010.4019.0000</td></tr> <tr><td>18 mm [0.71"]</td><td>8.0010.4080.0000</td></tr> <tr><td>20 mm [0.79"]</td><td>8.0010.4011.0000</td></tr> <tr><td>25 mm [0.98"]</td><td>8.0010.4012.0000</td></tr> <tr><td>30 mm [1.18"]</td><td>8.0010.4016.0000</td></tr> <tr><td>32 mm [1.26"]</td><td>8.0010.4015.0000</td></tr> <tr><td>1/2"</td><td>8.0010.4013.0000</td></tr> <tr><td>5/8"</td><td>8.0010.4070.0000</td></tr> <tr><td>3/4"</td><td>8.0010.4090.0000</td></tr> <tr><td>1"</td><td>8.0010.4050.0000</td></tr> <tr><td>1 1/4"</td><td>8.0010.4060.0000</td></tr> </table>	12 mm [0.47"]	8.0010.4091.0000	14 mm [0.55"]	8.0010.4027.0000	15 mm [0.59"]	8.0010.4038.0000	16 mm [0.63"]	8.0010.4019.0000	18 mm [0.71"]	8.0010.4080.0000	20 mm [0.79"]	8.0010.4011.0000	25 mm [0.98"]	8.0010.4012.0000	30 mm [1.18"]	8.0010.4016.0000	32 mm [1.26"]	8.0010.4015.0000	1/2"	8.0010.4013.0000	5/8"	8.0010.4070.0000	3/4"	8.0010.4090.0000	1"	8.0010.4050.0000	1 1/4"	8.0010.4060.0000	
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<p>Isolation insert for hollow shaft, \varnothing 42 mm [1.65"]</p>	<p>external diameter 42 mm [1.65"] / internal diameter 38 mm [1.50"] external diameter 42 mm [1.65"] / internal diameter 12 mm [0.47"]</p>	<p>8.0010.4017.0000 8.0010.4029.0000</p>																												

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

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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 at 60°C [140°F] 2500 min ⁻¹	Output circuit	SinCos U = 1 Vpp	SinCos U = 1 Vpp
Mass moment of inertia	< 220 x 10 ⁻⁶ kgm ²	Power supply	5 V DC (±5 %)	10 ... 30 V DC
Starting torque with sealing at 20°C [68°F]	< 0.2 Nm	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 no. E224618	
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 no. E224618		
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.

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

Incremental encoders

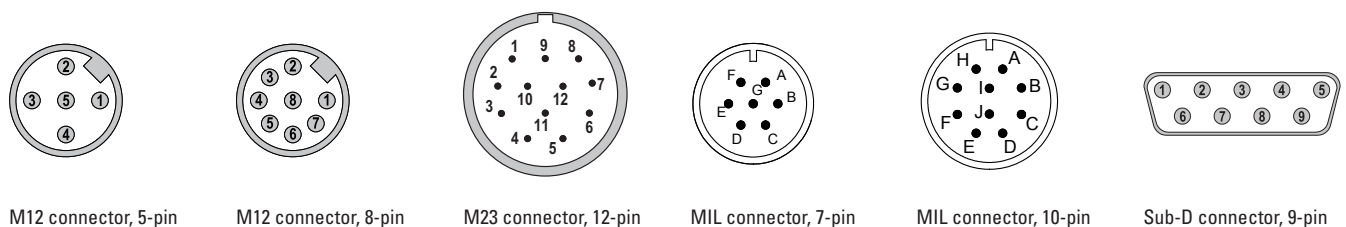
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Terminal assignment

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⁾		

- +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

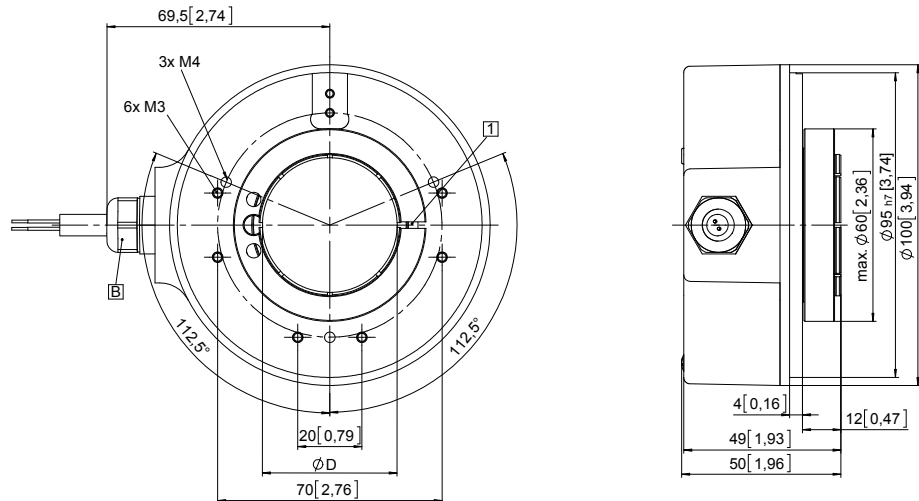
Dimensions hollow shaft version

Dimensions in mm [inch]

Flange without mounting aid Flange type 1

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

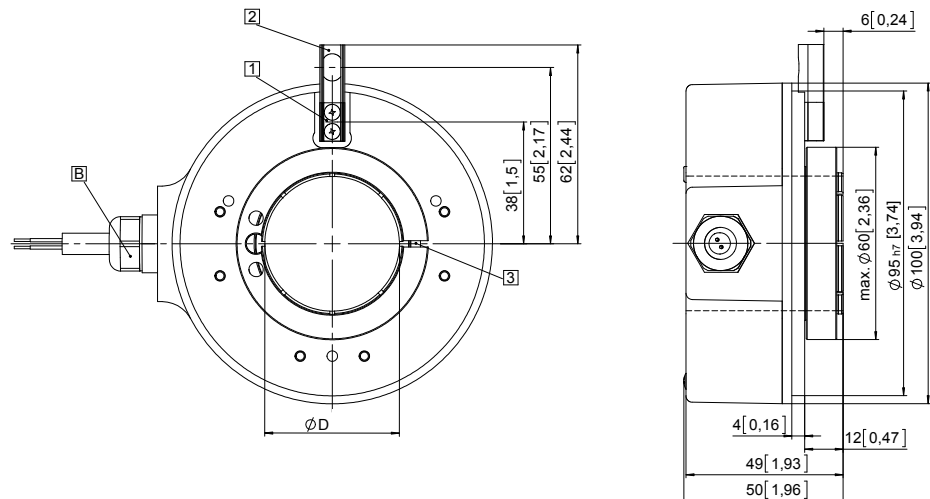
D	Fit
20 [0.79]	H7
25 [0.98]	H7
28 [1.10]	H7
30 [1.18]	H7
38 [1.50]	H7
40 [1.57]	H7
42 [1.65]	H7
5/8"	H7
1"	H7
1 1/4"	H7



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

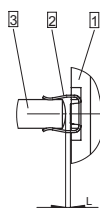
D	Fit
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25 [0.98]	H7
28 [1.10]	H7
30 [1.18]	H7
38 [1.50]	H7
40 [1.57]	H7
42 [1.65]	H7
5/8"	H7
1"	H7
1 1/4"	H7



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!

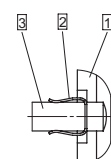
- 1 Flange
- 2 Spring element, short
- 3 Cylindrical pin



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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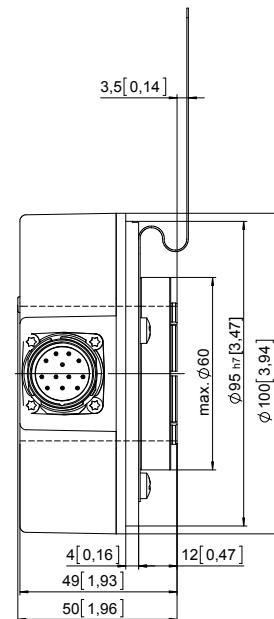
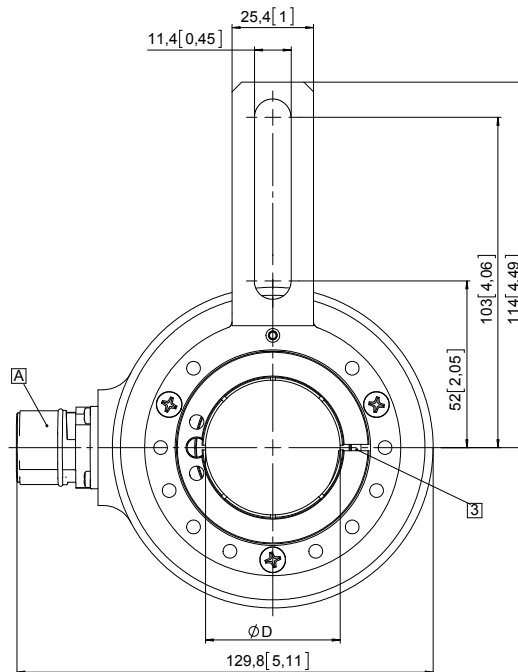
Dimensions hollow shaft version

Dimensions in mm [inch]

Flange with torque stop, long Flange type 5

- ③ Recommended torque for the clamping ring 2.0 Nm
- Ⓐ Plug version

D	Fit
20 [0.79]	H7
25 [0.98]	H7
28 [1.10]	H7
30 [1.18]	H7
38 [1.50]	H7
40 [1.57]	H7
42 [1.65]	H7
5/8"	H7
1"	H7
1 1/4"	H7



Flange with torque stop, short 4.5" Flange type 6

- ③ Recommended torque for the clamping ring 2.0 Nm
- Ⓐ Plug version

D	Fit
20 [0.79]	H7
25 [0.98]	H7
28 [1.10]	H7
30 [1.18]	H7
38 [1.50]	H7
40 [1.57]	H7
42 [1.65]	H7
5/8"	H7
1"	H7
1 1/4"	H7

