

# Incremental encoders

<b>Large hollow shaft robust, optical</b>	<b>A02H (hollow shaft)</b>	<b>Push-pull / RS422 / SinCos</b>
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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" <sup>1)</sup>

#### b Through 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"]
- 2 = ø 38 mm [1.50"]
- B = ø 40 mm [1.57"]
- 1 = ø 42 mm [1.65"]
- 4 = ø 1"

- E = ø 5/8" <sup>1)</sup>
- N = ø 1 1/4" <sup>1)</sup>

#### c Output circuit / power supply

- 1 = RS422 (with inverted signal) / 5 V DC
- 4 = RS422 (with inverted signal) / 10 ... 30 V DC
- 2 = Push-pull (without inverted signal) / 10 ... 30 V DC
- 5 = Push-pull (with inverted signal) / 5 ... 30 V DC
- 3 = Push-pull (with inverted signal) / 10 ... 30 V DC
- 8 = SinCos, 1 Vpp (with inverted signal) / 5 V DC
- 9 = SinCos, 1 Vpp (with inverted signal) / 10 ... 30 V DC
- A = Push-pull (7272 compatible) / 5 ... 30 V DC
- D = RS422 (with inverted signal) / 5 ... 30 V DC <sup>1)</sup>

#### d Type of connection

- 1 = radial cable, 1 m [3.28'] PVC
- A = radial cable, special length PVC \*)
- 2 = radial M23 connector, 12-pin, without mating connector
- E = radial M12 connector, 8-pin
- G = Sub-D connector, male contact, 9-pin, double-row <sup>2)</sup>
- D = MIL connector, 10-pin <sup>1)</sup>

\*) 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

#### Optional on request

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

1) US version.  
2) Protection level IP40.  
3) For the cable connection type, cable material PUR.

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<b>Mounting accessory for hollow shaft encoders</b>	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
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**Tether arm, flexible**

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

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]

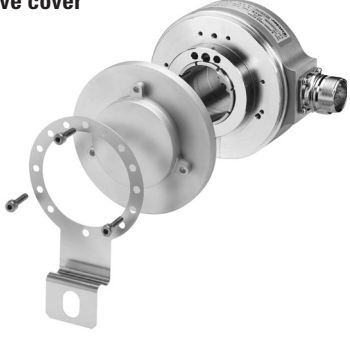


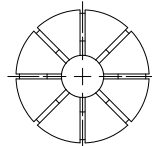
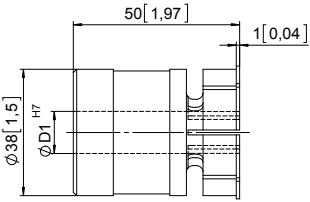
1 Socket screw M2.5 x 6 [0.24]  
2 Lock washer

**Torque stop, short**

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**

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Mounting accessory for hollow shaft encoders			Order no.
<b>Protective cover</b> 	For applications with a very high degree of pollution, Kübler now offers a protective cover for <ul style="list-style-type: none"> <li>Improved reliability</li> <li>Extension of the service life of the encoder</li> </ul> Scope of delivery: <ul style="list-style-type: none"> <li>Protective cover</li> <li>Torque stop (8.0010.4T00.0000)</li> <li>3 screws for fixing to the encoder</li> </ul>		<b>8.0010.40Y0.0001</b>
<b>Tapered shaft mounting kit</b> 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"> <li>Insert for cone blind hole, cone 1:10, 17 mm [0.67"] length</li> <li>Isolation insert</li> <li>Allen screw for central fixing</li> </ul>		<b>8.0010.4028.0000</b>
<b>Isolation insert for hollow shaft, <math>\varnothing</math> 38 mm [1.50"]</b> Temperature range -40°C ... +115°C [-40°F ... +239°F]   	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)	$\varnothing$ 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"	<b>8.0010.4091.0000</b> <b>8.0010.4027.0000</b> <b>8.0010.4038.0000</b> <b>8.0010.4019.0000</b> <b>8.0010.4080.0000</b> <b>8.0010.4011.0000</b> <b>8.0010.4012.0000</b> <b>8.0010.4016.0000</b> <b>8.0010.4015.0000</b> <b>8.0010.4013.0000</b> <b>8.0010.4070.0000</b> <b>8.0010.4090.0000</b> <b>8.0010.4050.0000</b> <b>8.0010.4060.0000</b>
<b>Isolation insert for hollow shaft, <math>\varnothing</math> 42 mm [1.65"]</b>	external diameter 42 mm [1.65"] / internal diameter 38 mm [1.50"] external diameter 42 mm [1.65"] / internal diameter 12 mm [0.47"]		<b>8.0010.4017.0000</b> <b>8.0010.4029.0000</b>
Connection technology			Order no.
<b>Cordset, pre-assembled</b>	M12 female connector with coupling nut, 8-pin 2 m [6.56'] PVC cable M23 female connector with coupling nut, 12-pin 2 m [6.56'] PVC cable		<b>05.00.6041.8211.002M</b> <b>8.0000.6201.0002</b>
<b>Connector, self-assembly (straight)</b>	M12 female connector with coupling nut, 8-pin M23 female connector with coupling nut, 12-pin		<b>05.CMB 8181-0</b> <b>8.0000.5012.0000</b>

Further accessories can be found in the accessories section or in the accessories area of our website at: [www.kuebler.com/accessories](http://www.kuebler.com/accessories).  
 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](http://www.kuebler.com/connection_technology).

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## Technical data

Mechanical characteristics	
<b>Maximum speed</b>	6000 min <sup>-1</sup> 1) at 60°C [140°F] 2500 min <sup>-1</sup> 1)
<b>Mass moment of inertia</b>	< 220 x 10 <sup>-6</sup> kgm <sup>2</sup> 2)
<b>Starting torque with sealing at 20°C [68°F]</b>	< 0.2 Nm
<b>Load capacity of shaft</b>	radial 200 N axial 100 N
<b>Weight</b>	approx. 0.8 kg [28.22 oz]
<b>Protection acc. to EN 60529</b>	IP65
<b>Working temperature range</b>	-40°C 3) ... +80°C [-40°F 3) ... +176°F]
<b>Materials</b>	shaft stainless steel, bore tolerance H7
<b>Shock resistance acc. to EN 60068-2-27</b>	2000 m/s <sup>2</sup> , 6 ms
<b>Vibration resistance acc. to EN 60068-2-6</b>	100 m/s <sup>2</sup> , 10 ... 2000 Hz

Electrical characteristics SinCos output		
<b>Output circuit</b>	<b>SinCos U = 1 Vpp</b>	<b>SinCos U = 1 Vpp</b>
<b>Power supply</b>	5 V DC (±5 %)	10 ... 30 V DC
<b>Power consumption with inverted signal (no load)</b>	typ. 65 mA max. 110 mA	typ. 65 mA max. 110 mA
<b>-3 dB frequency</b>	< 180 kHz	< 180 kHz
<b>Signal level</b>	channels A/B channel 0	1 Vpp (±20 %) 0.1 ... 1.2 V 1 Vpp (±20 %) 0.1 ... 1.2 V
<b>Short circuit proof outputs 4)</b>	yes	yes
<b>Reverse polarity protection of the power supply</b>	no	yes
<b>UL approval</b>	file no. E224618	
<b>GL approval</b>	letter of conformity No. 74130	
<b>CE compliant acc. to</b>	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU	

## Electrical characteristics RS422 / Push-pull

	<b>RS422 (TTL compatible)</b>	<b>Push-pull</b>	<b>Push-pull (7272 compatible)</b>
<b>Output circuit</b>			
<b>Power supply</b>	5 V DC (±5 %) 5 ... 30 V DC 10 ... 30 V DC	5 ... 30 V DC 10 ... 30 V DC	5 ... 30 V DC
<b>Power consumption (no load)</b>			
without inverted signal	–	typ. 55 mA/max. 125 mA	–
with inverted signal	typ. 40 mA/max. 90 mA	typ. 80 mA/max. 150 mA	typ. 50 mA/max. 100 mA
<b>Permissible load / channel</b>	max. +/- 20 mA	max. +/- 30 mA	max. +/- 20 mA
<b>Pulse frequency</b>	max. 300 kHz	max. 300 kHz	max. 300 kHz 5)
<b>Signal level</b>	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
<b>Rising edge time t<sub>r</sub></b>	max. 200 ns	max. 1 μs	max. 1 μs
<b>Falling edge time t<sub>f</sub></b>	max. 200 ns	max. 1 μs	max. 1 μs
<b>Short circuit proof outputs 4)</b>	yes	yes	yes
<b>Reverse polarity protection of the power supply</b>	no, 10 ... 30 V DC: yes	yes	no
<b>UL approval</b>	file no. E224618		
<b>GL approval</b>	letter of conformity No. 74130		
<b>CE compliant acc. to</b>	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<sub>max</sub> 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

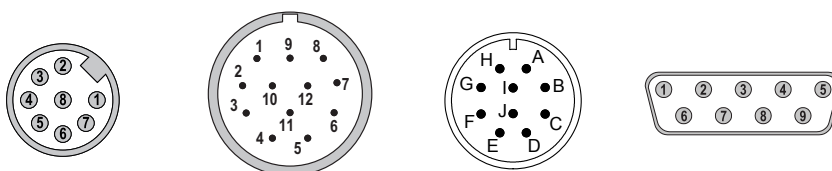
<b>Large hollow shaft robust, optical</b>	<b>A02H (hollow shaft)</b>	<b>Push-pull / RS422 / SinCos</b>
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## Terminal assignment

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
<b>M23 connector, 12-pin</b>													
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 <sup>1)</sup>
<b>M12 connector, 8-pin</b>													
1 ... D	E	Signal:	0 V	+V	0 Vsens	+Vsens	A	$\bar{A}$	B	$\bar{B}$	0	$\bar{0}$	$\perp$
		Pin:	1	2			3	4	5	6	7	8	PH <sup>1)</sup>
<b>MIL connector, 10-pin</b>													
1 ... D	D	Signal:	0 V	+V	0 Vsens	+Vsens	A	$\bar{A}$	B	$\bar{B}$	0	$\bar{0}$	$\perp$
		Pin:	F	D			A	G	B	H	C	I	J
<b>Sub-D connector, 9-pin</b>													
1 ... D	G	Signal:	0 V	+V	0 Vsens	+Vsens	A	$\bar{A}$	B	$\bar{B}$	0	$\bar{0}$	$\perp$
		Pin:	1	2			3	6	4	7	5	8	PH <sup>1)</sup>

- +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



M12 connector, 8-pin      M23 connector, 12-pin      MIL connector, 10-pin      Sub-D connector, 9-pin

1) PH = shield is attached to connector housing.

# Incremental encoders

**Large hollow shaft**  
robust, optical

**A02H (hollow shaft)**

**Push-pull / RS422 / SinCos**

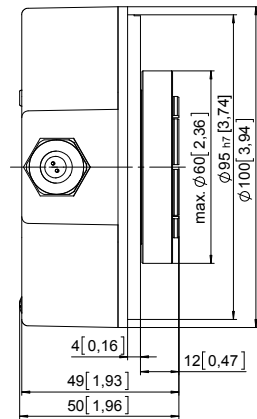
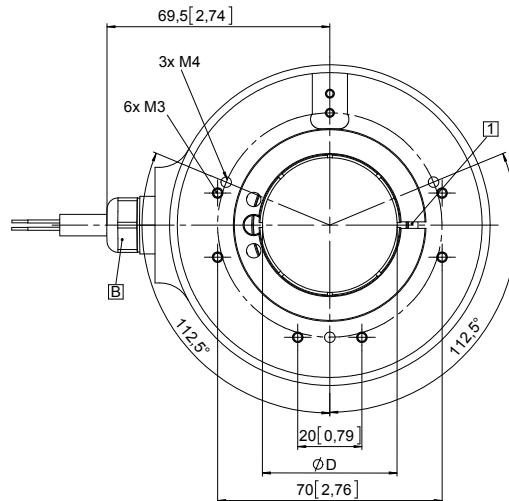
## Dimensions hollow shaft version

Dimensions in mm [inch]

### Flange without mounting aid Flange type 1

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

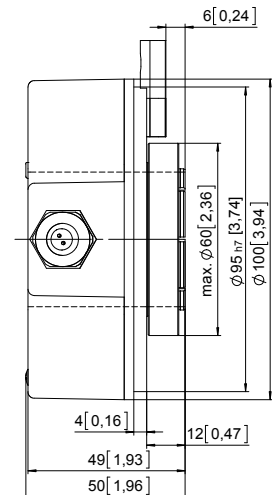
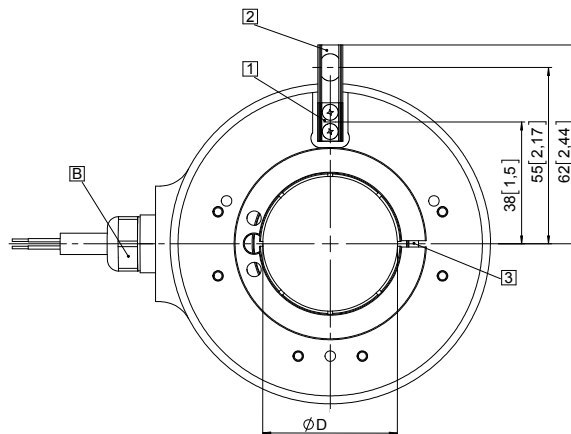
D	Fit
20 [0.79]	H7
25 [0.98]	H7
28 [1.10]	H7
30 [1.18]	H7
38 [1.50]	H7
40 [1.57]	H7
42 [1.65]	H7
5/8"	H7
1"	H7
1 1/4"	H7



### 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

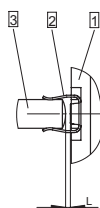
D	Fit
20 [0.79]	H7
25 [0.98]	H7
28 [1.10]	H7
30 [1.18]	H7
38 [1.50]	H7
40 [1.57]	H7
42 [1.65]	H7
5/8"	H7
1"	H7
1 1/4"	H7



### 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!

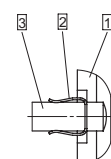
- 1 Flange
- 2 Spring element, short
- 3 Cylindrical pin



### 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

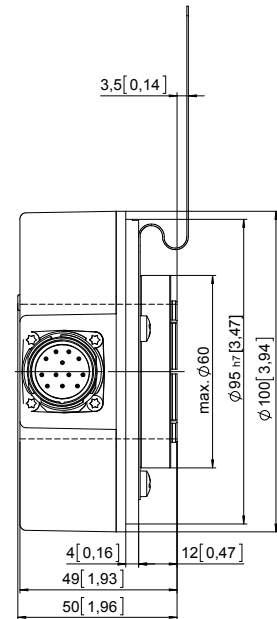
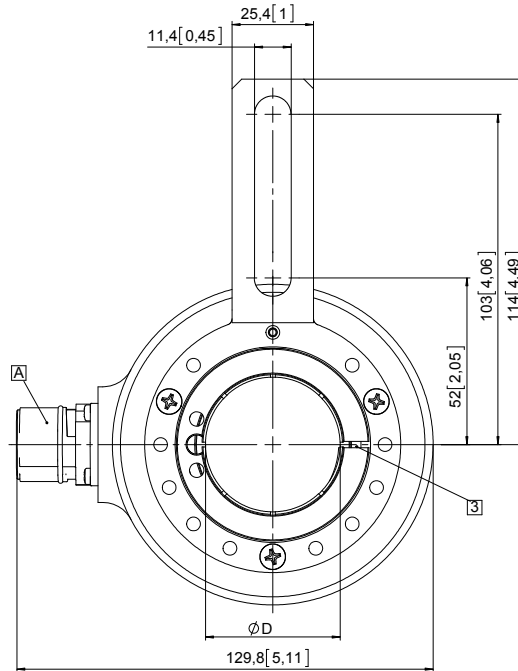
Dimensions in mm [inch]

### 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

