Large hollow shaft robust, optical | **A02H (hollow shaft)** | **Push-Pull / RS422 / SinCos**

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	.	X	X	X	X	.	XXXX	.	P	XX	X	X
Type		a	b	c	d		e			f	g	h

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

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

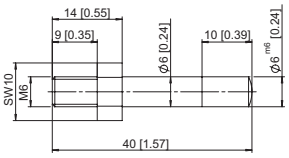
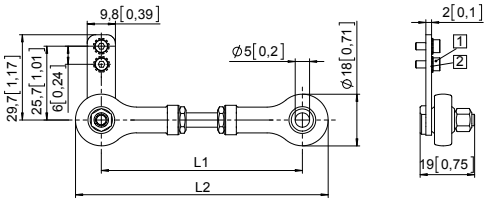
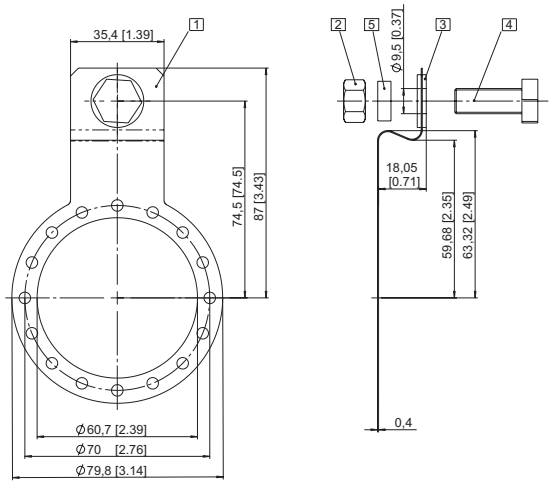
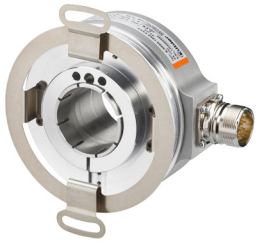
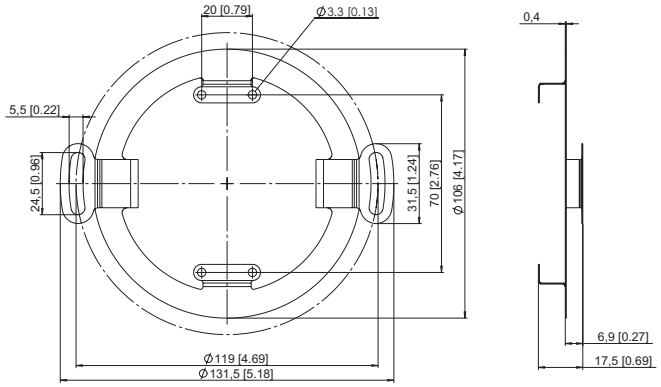
g *Special insert options*
A = isolation insert not included
B = isolation insert included

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..

Large hollow shaft robust, optical | A02H (hollow shaft) | Push-Pull / RS422 / SinCos

Mounting accessory for hollow shaft encoders	Dimensions in mm [inch]	Order no.
Torque pin, ø 6 mm for flange with spring element (flange type 2 + 3)	with fixing thread 	**8.0010.4700.0003**
Tether arm, flexible 	 1 Socket screw M2.5 x 6 [0.24] 2 Lock washer Tether arm: 70 mm [2.76"] — L1: 64 ... 74 [2.51 ... 2.91] — L2: 82 ... 92 [3.23 ... 3.62] Tether arm: 100 mm [3.94"] — L1: 94 ... 104 [3.70 ... 4.09] — L2: 112 ... 122 [4.41 ... 4.80] Tether arm: 150 mm [5.91"] — L1: 144 ... 154 [5.67 ... 6.06] — L2: 162 ... 172 [6.38 ... 6.77]	70 mm [2.76"] **8.0010.40S0.0000** 100 mm [3.94"] **8.0010.40T0.0000** 150 mm [5.91"] **8.0010.40U0.0000**
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	**8.0010.4T00.0000**
Stator coupling 		**8.0010.40V0.0000**

Large hollow shaft robust, optical	A02H (hollow shaft)	Push-Pull / RS422 / SinCos

Mounting accessory for hollow shaft encoders

Order no.

Protective cover

For applications with a very high degree of pollution, Kübler now offers a protective cover for
- Improved reliability
- Extension of the service life of the encoder

Scope of delivery:
- Protective cover
- Torque stop (8.0010.4T00.0000)
- 3 screws for fixing to the encoder

8.0010.40Y0.0001

Tapered shaft mounting kit

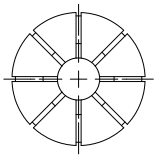
for A02H with hollow shaft, ø 38 mm [1.50“]

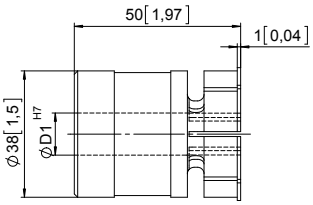
For use in upgrading for tapered shaft mounting. Tapered shafts are used for high-precision direct coupling.
An isolation insert is also included in the mounting kit; this reliably protects the encoder from shaft currents.
Included in the set:
- Insert for cone blind hole, cone 1:10, 17 mm [0.67“] length
- Isolation insert
- Allen screw for central fixing

8.0010.4028.0000

Isolation insert for hollow shaft, ø 38 mm [1.50“]

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)

ø D1:	
12 mm	**8.0010.4091.0000**
14 mm	**8.0010.4027.0000**
15 mm	**8.0010.4038.0000**
16 mm	**8.0010.4019.0000**
18 mm	**8.0010.4080.0000**
20 mm	**8.0010.4011.0000**
25 mm	**8.0010.4012.0000**
30 mm	**8.0010.4016.0000**
32 mm	**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**

Isolation insert for hollow shaft, ø 42 mm [1.65“]

external diameter 42 mm [1.65“] / internal diameter 38 mm [1.50“]	**8.0010.4017.0000**
external diameter 42 mm [1.65“] / internal diameter 12 mm [0.47“]	**8.0010.4029.0000**

Cables and connectors

Order no.

Preassembled cables

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**

Connectors

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**

Further Kübler accessories can be found at: kuebler.com/accessories
Further Kübler cables and connectors can be found at: kuebler.com/connection-technology

Large hollow shaft robust, optical | **A02H (hollow shaft)** | **Push-Pull / RS422 / SinCos**

Technical data

Mechanical characteristics

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

Approvals

GL-approval in accordance with	letter of conformity No. 74130
UL compliant in accordance with	File no. E224618
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
ATEX Directive	2014/34/EU (for Ex 2/22 variants)

Electrical characteristics SinCos output

Output circuit	**SinCos U = 1 Vpp**	**SinCos U = 1 Vpp**
Supply voltage	5 V DC (±5 %)	10 ... 30 V DC
Power consumption (no load)	typ. 65 mA max. 110 mA	typ. 65 mA max. 110 mA
-3 dB frequency	< 180 kHz	< 180 kHz
Signal level channels A/B	1 Vpp (±20 %)	1 Vpp (±20 %)
channel 0	0.1 ... 1.2 V	0.1 .... 1.2 V
Short circuit proof outputs [4]	yes	yes
Reverse polarity protection of the supply voltage	no	yes

Electrical characteristics RS422 / Push-pull

Output circuit	**RS422** (TTL compatible)	**Push-pull**	**Push-pull** (7272 compatible)
Supply voltage	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	–	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
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	min. +V – 3 V	min. +V - 2.0 V
LOW	max. 0.5 V	max. 2.5 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 supply voltage	no, 10 ... 30 V DC: yes	yes	no

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 supply voltage correctly applied.
5) Max. recommended cable length 30 m [98.43'].

Large hollow shaft robust, optical | **A02H (hollow shaft)** | **Push-Pull / RS422 / SinCos**

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	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
		Core color:	WH	BN	GY/PK	RD/BU	GN	YE	GY	PK	BU	RD	shield

Output circuit	Type of connection	M23 connector, 12-pin										
1 ... D	2	Signal:	0 V	+V	0 Vsens	+Vsens	A	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
		Pin:	10	12	11	2	5	6	8	1	3	4	PH [1]

Output circuit	Type of connection	M12 connector, 8-pin								
1 ... D	E	Signal:	0 V	+V	A	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
		Pin:	1	2	3	4	5	6	7	8	PH [1]

Output circuit	Type of connection	M12 connector, 5-pin						
1 ... D	R	Signal:	0 V	+V	A	B	0	⏚
		Pin:	1	2	3	4	5	PH [1]

Output circuit	Type of connection	MIL connector, 10-pin									
1 ... D	D	Signal:	0 V	+V	+Vsens	A	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
		Pin:	F	D	E	A	G	B	H	C	I	J

Output circuit	Type of connection	MIL connector, 7-pin						
1 ... D	K	Signal:	0 V	+V	+Vsens	A	B	0	⏚
		Pin:	F	D	E	A	B	C	J

Output circuit	Type of connection	Sub-D connector, 9-pin									
1 ... D	G	Signal:	0 V	+V	A	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
		Pin:	1	2	3	6	4	7	5	8	PH [1]

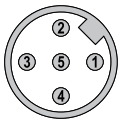
Terminal assignment – Special connector pin configuration

Order code h	Output circuit	Type of connection	M12 connector, 8-pin								
7	1 ... D	E	Signal:	0 V	+V	A	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
			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	$\overline{A}$	B	$\overline{B}$	0	$\overline{0}$	⏚
			Pin:	F	D	A	H	B	I	C	J	G

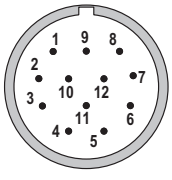
+V: Encoder power supply +V DC
0 V: Encoder power supply ground GND (0 V)
0 V_{sens} / +V_{sens}: Using the sensor outputs of the encoder, the voltage present can be measured and if necessary increased accordingly.
A, $\overline{A}$: Incremental output channel A
B, $\overline{B}$: Incremental output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

Top view of mating side, male contact base

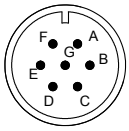


M12 connector, 5-pin

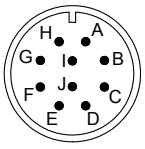
M12 connector, 8-pin



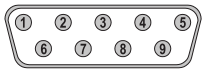
M23 connector, 12-pin



MIL connector, 7-pin



MIL connector, 10-pin



Sub-D connector, 9-pin

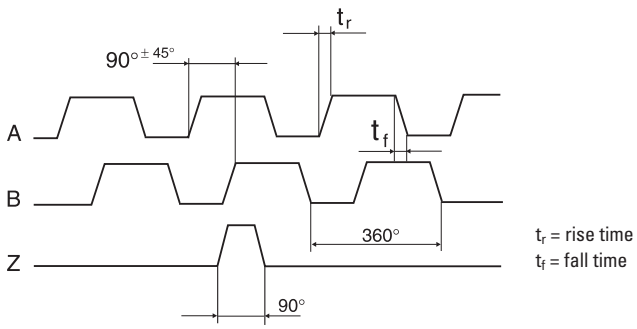
1) PH = shield is attached to connector housing.

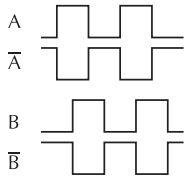
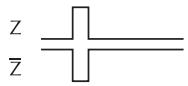
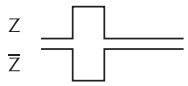
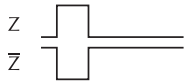
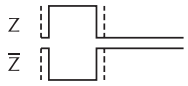
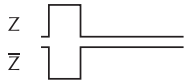
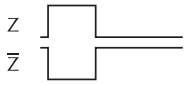
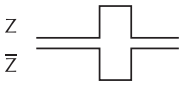
Large hollow shaft robust, optical | **A02H (hollow shaft)** | **Push-Pull / RS422 / SinCos**

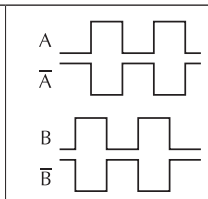
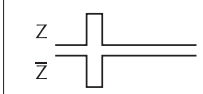
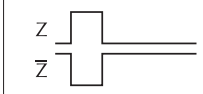
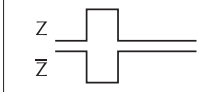
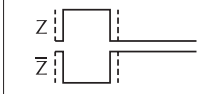
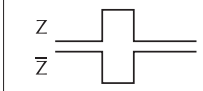
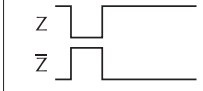
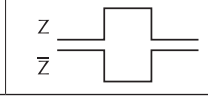
Special output signal formats

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.		
Order code ⓘ		
	Z gated with A & B. This is the Kübler standard. Z is 90° wide.	
01	Z gated with B. Z is 180° wide.	
02	Z gated with A. Z is 180° wide.	
03	Z ungated. Z is 330° to 360° wide.	
08	Z is 180° wide	
11	Z is a minimum with of 270° (electrical degrees).	
13	Z gated with $\overline{B}$. Z is 180° wide.	

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.		
Order code ⓘ		
04	Z gated with A & B. Z is 90° wide.	
05	Z gated with B. Z is 180° wide.	
06	Z gated with A. Z is 180° wide.	
07	Z ungated. Z is 330° to 360° wide.	
09	Z gated with $\overline{B}$. Z is 180° wide.	
10	Z is a negative marker gated with B. Z is 180° wide.	
12	Z has a minimum width of 270°.	

Large hollow shaft robust, optical | **A02H (hollow shaft)** | **Push-Pull / RS422 / SinCos**

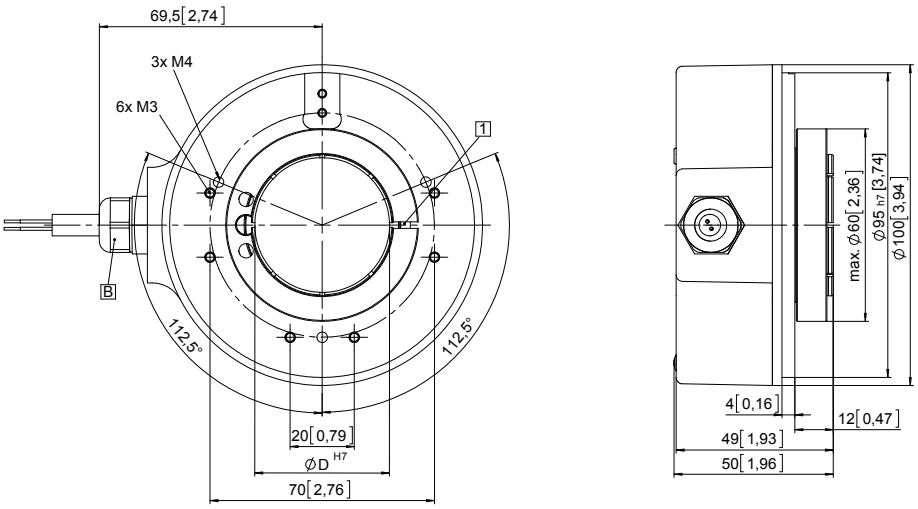
Dimensions hollow shaft version

Dimensions in mm [inch]

Flange without mounting aid
Flange type 1

1 Recommended torque for the clamping ring 1.0 Nm

B Cable version



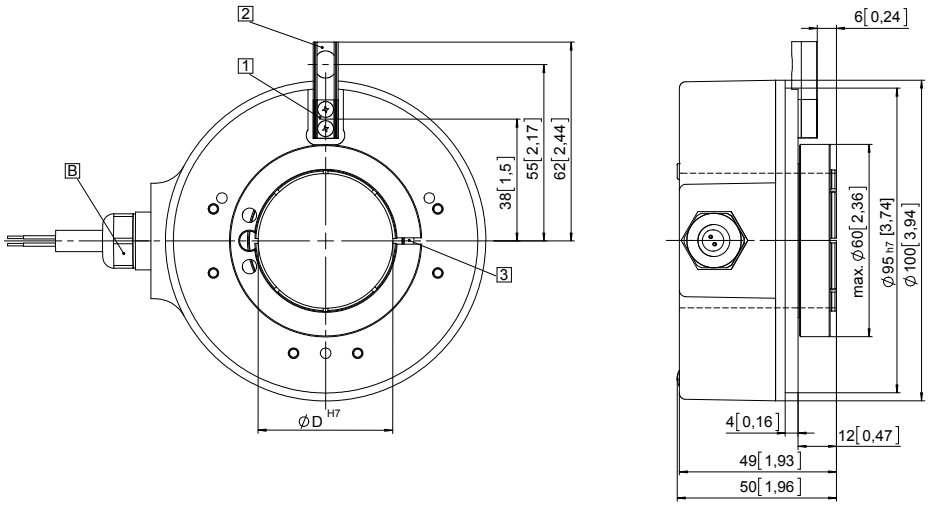
Flange with spring element
Flange type 2 and 3

1 Spring element, short (flange type 2)

2 Spring element, long (flange type 3)

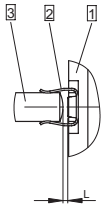
3 Recommended torque for the clamping ring
flange type 2: 1.0 Nm
flange type 3: 2.0 Nm

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!



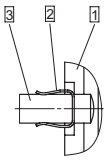
1 Flange

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

Large hollow shaft robust, optical | **A02H (hollow shaft)** | **Push-Pull / RS422 / SinCos**

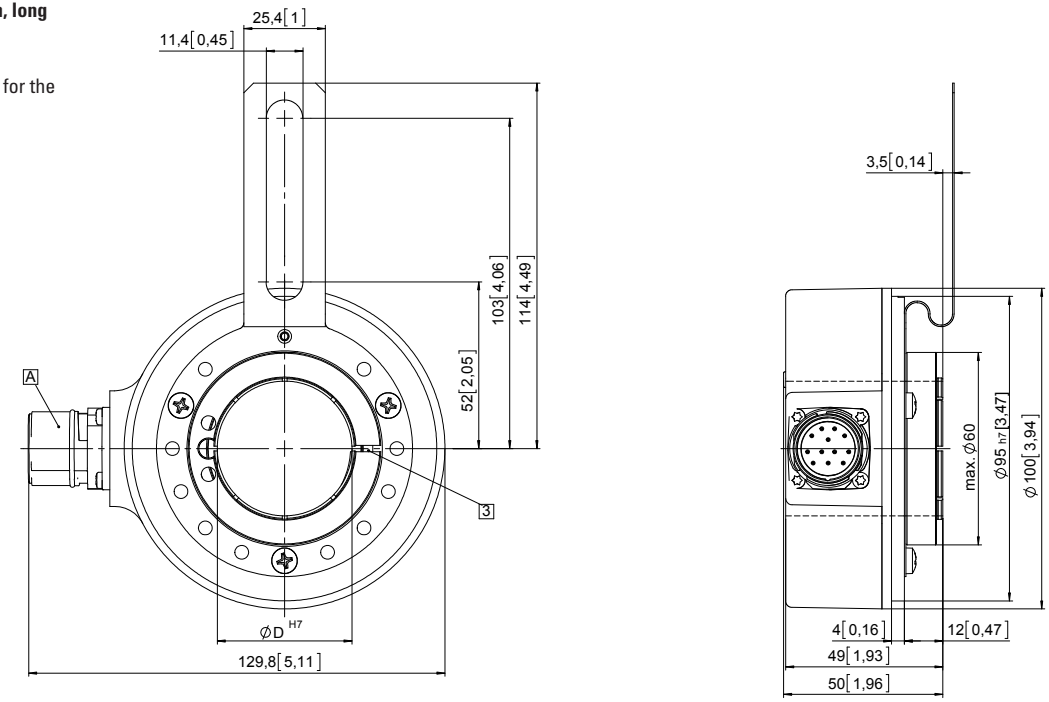
Dimensions hollow shaft version

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
(Set 8.0010.4T00.0000 enclosed)
Flange type 6

3 Recommended torque for the clamping ring 2.0 Nm

A Plug version