

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	.XXXXX.	.XXXX.	.PXXXX
		Type	a b c d	e	f g h

<p>a Flange</p> <p>1 = without mounting aid 2 = with spring element, short 3 = with spring element, long 5 = with fastening arm, long 6 = with fastening arm, short</p> <p>b Hollow shaft</p> <p>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"</p>	<p>c Output circuit (with inverted signal) / power supply</p> <p>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</p> <p>d Type of connection</p> <p>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-pin⁴⁾ G = Sub-D connector, male contact, 9-pin, double-row²⁾ K = MIL connector, 7-pin¹⁾⁴⁾ D = MIL connector, 10-pin</p> <p>*) 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)</p>	<p>e Pulse rate</p> <p>50, 360, 512, 600, 1000, 1024, 1500, 2000, 2048, 2500, 4096, 5000 (e.g. 360 pulses => 0360)</p> <p>SinCos version only available with pulses ≥ 1024</p> <p>f Special output signal formats</p> <p>00 = standard output other = see page 6</p> <p>g Special insert options</p> <p>A = isolation insert not included B = isolation insert included</p> <p>h Special connector pin configuration</p> <p>0 = standard wiring other = see page 5</p> <p>Optional on request - other pulse rates on request - Ex 2/22³⁾</p>
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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	Dimensions in mm [inch]	Order no.
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Torque pin, ø 6 mm
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"]	8.0010.40S0.0000 8.0010.40T0.0000 8.0010.40U0.0000
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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




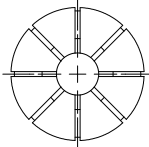
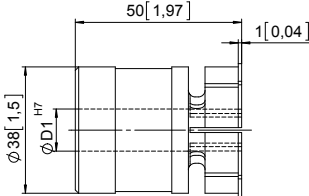
	8.0010.4T00.0000
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- 1 Curved spring element
- 2 Hexagonal nut 3/8 - 16 UNC
- 3 Washer (isolating)
- 4 Hexagonal screw 3/8 16 UNC x 1"
- 5 Washer D10.4 x 15 x 15

Stator coupling

	8.0010.40V0.0000
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Mounting accessory for hollow shaft encoders			Order no.
Protective cover 		For applications with a very high degree of pollution, Kübler now offers a protective cover for <ul style="list-style-type: none"> Improved reliability Extension of the service life of the encoder Scope of delivery: <ul style="list-style-type: none"> 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, \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 14 mm 15 mm 16 mm 18 mm 20 mm 25 mm 30 mm 32 mm 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 insert for hollow shaft, \varnothing 42 mm [1.65"] 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)		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
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

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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 %) channel 0 0.1 ... 1.2 V	1 Vpp (±20 %) 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 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 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'].

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Terminal assignment – Standard wiring

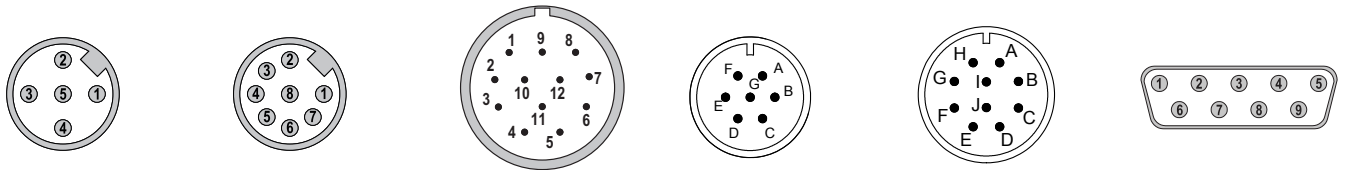
Output circuit	Type of connection	Cable (isolate unused cores individually before initial start-up)											
1 ... D	1, A	Signal:	0 V	+V	0 Vsens	+Vsens	A	\bar{A}	B	\bar{B}	0	$\bar{0}$	\perp
		Core color:	WH	BN	GY/PK	RD/BU	GN	YE	GY	PK	BU	RD	shield
		M23 connector, 12-pin											
1 ... D	2	Signal:	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



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.

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**Large hollow shaft
robust, optical**

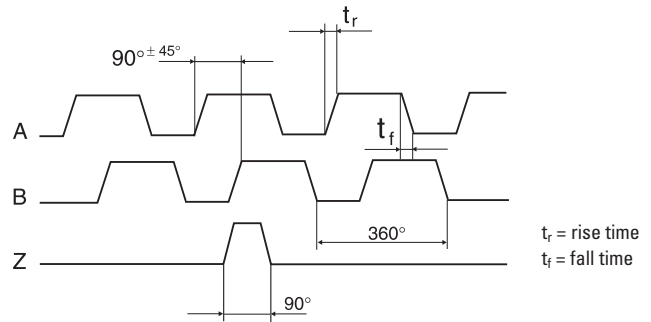
A02H (hollow shaft)

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}

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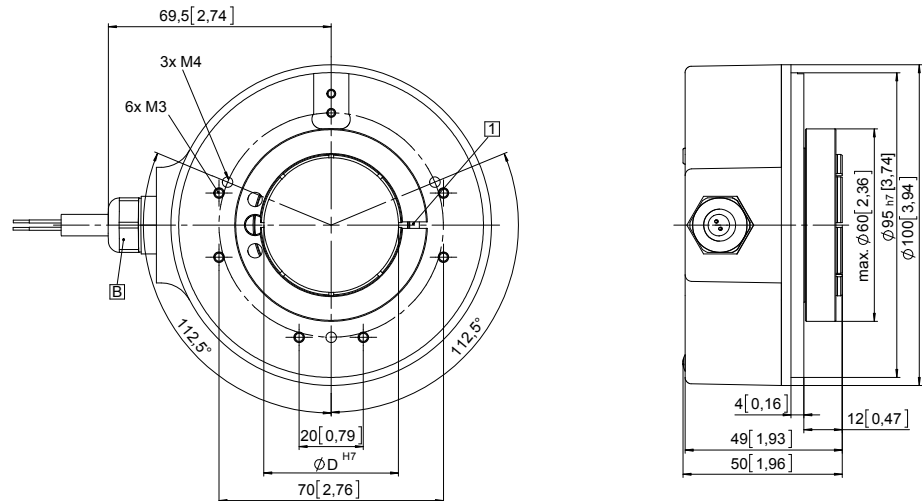
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Dimensions hollow shaft version

Dimensions in mm [inch]

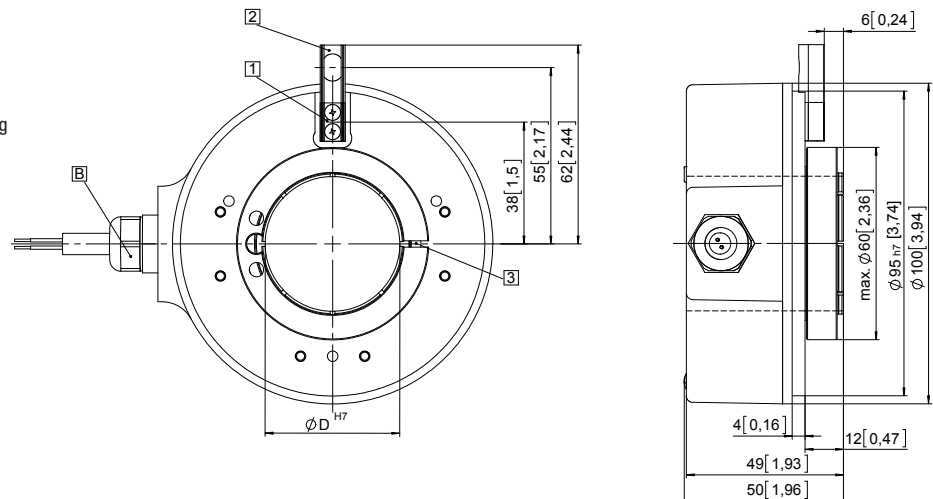
Flange without mounting aid Flange type 1

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



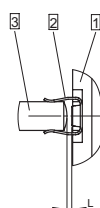
Flange with spring element Flange type 2 and 3

- 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

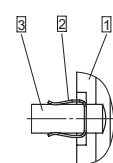
When mounting the encoder, ensure that dimension L is larger than the maximum axial play of the drive in the direction of the arrow.
Danger of mechanical seizure!



- 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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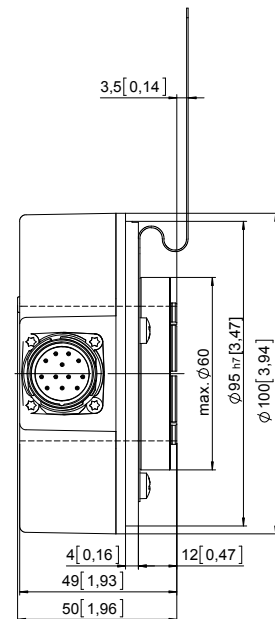
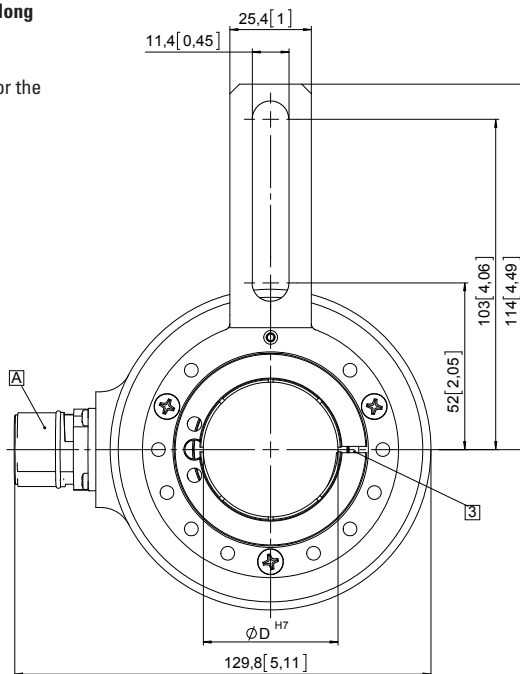
Push-Pull / RS422 / SinCos

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

