DFS60
Incremental Encoders

High-resolution, programmable encoder for
sophisticated applications

SICK
Sensor Intelligence.

High-resolution, programmable encoder for sophisticated applications

UL certification not valid for all types. See order information

Additional information

Product description

The DFS60 is a high-resolution incremental encoder with a diameter of 60 mm. It offers a wide variety of customer-specific mechanical and electric adjustments. Programming of the output signal, zero pulse and resolution of up to 65,356 pulses is a unique feature for the market. The high enclosure rating, wide temperature range and large ball bearing distance make the DFS60 the ideal encoder for industrial applications in harsh environments.

At a glance

- Compact installation depth
- High resolution up to 16 bits
- Optionally programmable: Output voltage, zero pulse position, zero pulse width and number of pulses
- Connection: Radial or axial cable outlet, M23 or M12 connector, axial or radial
- Electrical interfaces: 5 V & 24 V TTL/ RS-422, 24 V HTL/push pull
- Mechanical interfaces: face mount or servo flange, blind or through hollow shaft
- Remote 0-SET possible

Your benefit

- Reduced storage costs and downtime due to customer-specific programming
- Variety of different mechanical and electrical interfaces enable the encoder to be optimally adjusted to fit the installation situation
- Excellent concentricity even at high speeds
- High resolution of up to 16 bits ensures precise measurements
- Permanent and safe operation due to a high enclosure rating, temperature resistance and a long bearing lifetime
- Programmability via the PGT-08 programming software and the PGT-10-S display programming tool allow the encoder to be adapted flexibly and quickly according to customer needs
- Programmable zero pulse position simplifies installation

→ **www.mysick.com/en/DFS60**

For more information, just enter the link or scan the QR code and get direct access to technical data, CAD design models, operating instructions, software, application examples and much more.

Detailed technical data

Performance

	E	B	A
Pulses per revolution [1], [2]	100 ... 2048 [2]	1 ... 10000 [2]	1 ... 65536 [2]
Pulses per revolution at SIN/COS 1.0 V_{PP} interface	–	1024	–
Measuring step	90° electrical / pulses		
Reference signal			
Number	1		
Position	90° electr., logic operation with A and B/sine and cosine		
Error limits	± 0.3°	± 0.05°	± 0.03°
Measuring step deviation			
Pulses 1 ... 99	–	± 0.08°	± 0.04°
Pulses 100 ... 10000	± 0.2°	± 0.01°	± 0.008°
Pulses > 10000	–	–	± 0.002°

[1] See maximum revolution range on page 6.

[2] Detailed list of pulses per revolution on page 13.

Mechanical data

Shaft diameter	
Face mount flange	10 x 19 mm
Servo flange	6 x 10 mm
Blind hollow shaft, through hollow shaft	6, 8, 10, 12, 14, 15 mm and 3/8", 1/2", 5/8"
Material shaft	Stainless steel
Material flange	Aluminium
Material housing	Aluminium
Mass [1]	
Face mount flange, servo flange	0.3 kg [1]
Blind hollow shaft, through hollow shaft	0.2 kg [1]
Start-up torque at 20 °C	
Face mount flange, servo flange	0.5 Ncm
Blind hollow shaft, through hollow shaft	0.8 Ncm
Operating torque at 20 °C	
Face mount flange, servo flange	0.3 Ncm
Blind hollow shaft, through hollow shaft	0.6 Ncm
Permissible shaft loading	
Face mount flange, servo flange	80 N radial 40 N axial
Permissible shaft movement of the drive element static/dynamic	
Blind hollow shaft, through hollow shaft	±0.3 / ±0.1 mm radial ±0.5 / ±0.2 mm axial ±0.3 / ±0.05 mm radial ±0.5 / ±0.1 mm axial
Angular acceleration	5×10^5 rad/s^2
Operating speed [2]	
Face mount flange, servo flange	9000 min^{-1}
Blind hollow shaft	6000 min^{-1}
Through hollow shaft	9000 min^{-1}

[1] Based on encoders with a connector outlet.

[2] Self warming 3.3 k/1,000 min^{-1}, when applying note working temperature range.

	E	B	A
Rotor moment of inertia			
Face mount flange, servo flange	6.2 gcm²		
Blind hollow shaft, through hollow shaft	40 gcm²		
Bearing lifetime	$3{,}6 \times 10^{10}$ revolutions		

[1] Based on encoders with a connector outlet.

[2] Self warming 3.3 k/1,000 min^{-1}, when applying note working temperature range.

Electrical data

	E	B	A
Electrical interfaces	4.5 ... 5.5 V, TTL/RS422		
	10 ... 32 V, TTL/RS422		
	10 ... 32 V, HTL/push pull		
	–	4.5 V ... 5.5 V, Sin/Cos 1.0 V_{PP}	–
	–	4.5 ... 5.5 V, TTL/RS422, with 0-set function on the M23 connector	
	–	10 ... 32 V, TTL/RS422, with 0-set function on the M23 connector	
	–	10 ... 32 V, HTL/push pull, with 0-set function on the M23 connector	
	–	4.5 ... 32 V, TTL/HTL programmable [1]	
	–	4.5 ... 32 V, TTL or HTL programmable with 0-set function on the M23 connector [1], [2]	
Initialization time after Power On			
4.5 ... 5.5 V, TTL/RS422	40 ms		
10 ... 32 V, TTL/RS422	40 ms		
10 ... 32 V, HTL/push pull	40 ms		
4.5 V...5.5 V, Sin/Cos 1.0 V_{PP}	–	40 ms	–
4.5 ... 5.5 V, TTL/RS422, 0-SET	–	Max. 30 ms	
10 ... 32 V, TTL/RS422, 0-SET	–	Max. 30 ms	
10 ... 32 V, HTL/push pull, 0-SET	–	Max. 30 ms	
4.5 ... 32 V, TTL/HTL programmable	–	Max. 30 ms/max. 32 ms with mechanical zero pulse width	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	Max. 30 ms/max. 32 ms with mechanical zero pulse width	
0-SET function [2]	–	H – active; (L = 0 ... 3 V, H = 4 ... U_S V)	
Load current			
4.5 ... 5.5 V, TTL/RS422	30 mA		
10 ... 32 V, TTL/RS422	30 mA		
10 ... 32 V, HTL/push pull	30 mA		
4.5 ... 5.5 V, TTL/RS422, 0-SET	–	30 mA	
10 ... 32 V, TTL/RS422, 0-SET	–	30 mA	
10 ... 32 V, HTL/push pull, 0-SET	–	30 mA	
4.5 ... 32 V, TTL/HTL pro programmable	–	30 mA	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	30 mA	

[1] Factory settings: Output level TTL.

[2] Only with devices with M23 connector outlet in connection with the electrical interfaces M, U, V and W.

[3] Short-circuit opposite to another channel, US or GND permissible for max. 30 s.

[4] Short-circuit opposite to another channel, or GND permissible for max. 30 s.

[5] This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40 °C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

	E	B	A
Load resistance			
4.5 V...5.5 V, Sin/Cos 1.0 V_{PP}	–	Min. 120 Ω	–
Operating current with no load			
4.5 ... 5.5 V, TTL/RS422	40 mA		
4.5 V...5.5 V, Sin/Cos 1.0 V_{PP}	–	40 mA	–
Power consumption with no load			
10 ... 32 V, TTL/RS422	0.5 W		
10 ... 32 V, HTL/push pull	0.5 W		
4.5 ... 5.5 V, TTL/RS422, 0-SET	–	0.7 W	
10 ... 32 V, TTL/RS422, 0-SET	–	0.7 W	
10 ... 32 V, HTL/push pull, 0-SET	–	0.7 W	
4.5 ... 32 V, TTL/HTL pro programmable	–	0.7 W	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	0.7 W	
Reverse polarity protection			
4.5 ... 5.5 V, TTL/RS422	No		
10 ... 32 V, TTL/RS422	Yes		
10 ... 32 V, HTL/push pull	Yes		
4.5 V...5.5 V, Sin/Cos 1.0 V_{PP}	–		
4.5 ... 5.5 V, TTL/RS422, 0-SET	–	Yes	
10 ... 32 V, TTL/RS422, 0-SET	–	Yes	
10 ... 32 V, HTL/push pull, 0-SET	–	Yes	
4.5 ... 32 V, TTL/HTL programmable	–	Yes	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	Yes	
Short-circuit protection of the outputs			
4.5 ... 5.5 V, TTL/RS422	Yes [3]		
10 ... 32 V, TTL/RS422	Yes [4]		
10 ... 32 V, HTL/push pull	Yes [3]		
4.5 V...5.5 V, Sin/Cos 1.0 V_{PP}	–	Yes [3]	–
4.5 ... 5.5 V, TTL/RS422, 0-SET	–	Yes [3]	
10 ... 32 V, TTL/RS422, 0-SET	–	Yes [4]	
10 ... 32 V, HTL/push pull, 0-SET	–	Yes [3]	
4.5 ... 32 V, TTL/HTL programmable	–	Yes, HTL [3] and TTL [4]	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	Yes, HTL [3] ans TTL [4]	
MTTFd: mean time to dangerous failure [5]	300 years (EN ISO 13849-1)		

[1] Factory settings: Output level TTL.

[2] Only with devices with M23 connector outlet in connection with the electrical interfaces M, U, V and W.

[3] Short-circuit opposite to another channel, US or GND permissible for max. 30 s.

[4] Short-circuit opposite to another channel, or GND permissible for max. 30 s.

[5] This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40 °C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

Ambient data

	E	B	A
EMC [1]	As per EN 61000-6-2 and EN 61000-6-3		
Enclosure rating as per IEC 60529			
On the shaft	IP 65		
On the housing, connector outlet [2]	IP 67 (through hollow shaft IP 65)		
On the housing, cable outlet	IP 67 (through hollow shaft IP 65)		
Permissible relative air humidity	90 % condensation on the optical scanner not permissible		
Working temperature range	0 ... +85 °C	–30 ... +100 °C	
Storage temperature range (without packaging)	–40 ... +100 °C		
Resistance			
To shocks as per EN 60068-2-27	50 g/6 ms	70 g/6 ms	60 g/6 ms
To vibration as per EN 60068-2-6	20 g/ 10 ... 2,000 Hz	30 g/ 10 ... 2,000 Hz	20 g/ 10 ... 2,000 Hz

[1] For the interfaces 10 ... 32 V, TTL/RS422 and 10 ... 32 V, HTL/push pull as per EN 61000-6-2 and EN 61000-6-4, devices of class A.

[2] When the mating connector is fitted.

Maximum revolution range

Speed consideration (n)

Steps per revolution (y-axis): 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440, 65536

Speed N [min⁻¹] (x-axis): 0, 2000, 4000, 6000, 8000, 10000, 12000
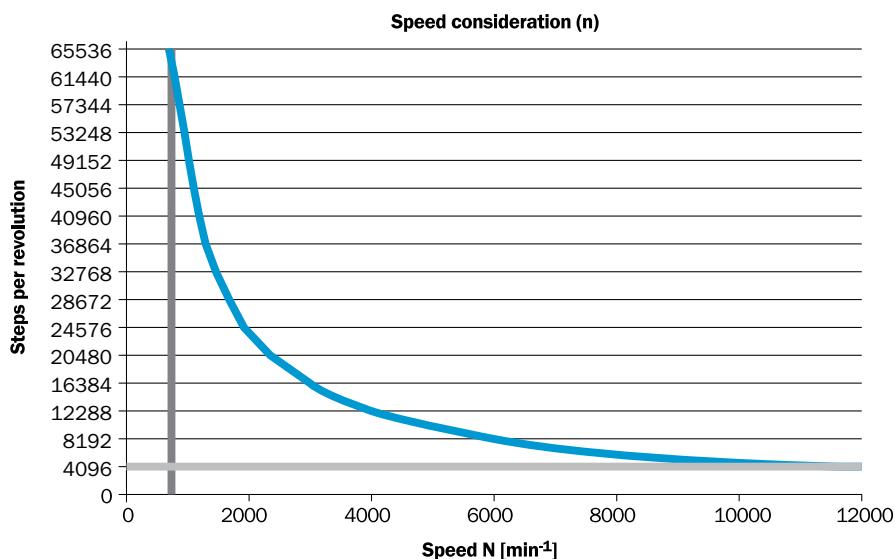
Ordering information

Type code for face mount flange and servo flange, **programmable**

Type

| B | Pulses per revolution programmable 1 ... 10000 |
| A | Pulses per revolution programmable 1 ... 65536 |

Mechanical design

| 4 | Face mount flange, 10 x 19 mm solid shaft |
| 1 | Servo flange, 6 x 10 mm solid shaft |

Electrical interface (factory setting: output level TTL)

| P | 4.5 ... 32 V, TTL/HTL programmable |
| M | 4.5 ... 32 V, TTL/HTL programmable with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B) |

Connection type

A	M23 connector, 12-pin, radial
B	M23 connector, 12-pin, axial (no UL certification)
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial (no UL certification)
K	8-core cable, universal 1.5 m [1]
L	8-core cable, universal 3 m [1]
M	8-core cable, universal 5 m [1]

Resolution
(factory set pulses per revolution with type B: 10000, with type A: 65536)

Always 5 digits in text, see "Pulses per revolution" on page 13

| D | F | S | 6 | 0 | | – | S | | | | | | | | | |

[1] The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

The following features can be programmed:

- Pulses per revolution from 1 ... 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- Zero pulse width mechanically 1° ... 359° using programming tool PGT-10-S (see accessories on page 25).
- Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- 0-SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- 0-SET function via PIN 7 of the M23 connector by applying U_s for at least 250 ms.

Type code for blind hollow shaft, programmable

Type

B	Pulses per revolution programmable 1 … 10000
A	Pulses per revolution programmable 1 … 65536

Mechanical design

A	Blind hollow shaft, 6 mm
B	Blind hollow shaft, 8 mm
C	Blind hollow shaft, 3/8"
D	Blind hollow shaft, 10 mm
E	Blind hollow shaft, 12 mm
F	Blind hollow shaft, 1/2"
G	Blind hollow shaft, 14 mm
H	Blind hollow shaft, 15 mm
J	Blind hollow shaft, 5/8"

Electrical interface (factory setting: output level TTL)

P	4.5 … 32 V, TTL/HTL programmable
M	4.5 … 32 V, TTL/HTL programmable with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)

Connection type

A	M23 connector, 12-pin, radial
B	M23 connector, 12-pin, axial (no UL certification)
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial (no UL certification)
K	8-core cable, universal 1.5 m [1]
L	8-core cable, universal 3 m [1]
M	8-core cable, universal 5 m [1]

Resolution
(factory set pulses per revolution with type B: 10000, with type A: 65536)

Always 5 digits in text, see "Pulses per revolution" on page 13

D	F	S	6	0		–	B								

[1] The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

The following features can be programmed:

- Pulses per revolution from 1 … 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- Zero pulse width mechanically 1° … 359° using programming tool PGT-10-S (see accessories on page 25).
- Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- 0-SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- 0-SET function via PIN 7 of the M23 connector by applying U_s for at least 250 ms.

Type code for through hollow shaft, **programmable**

Type

| B | Pulses per revolution programmable 1 ... 10000 |
| A | Pulses per revolution programmable 1 ... 65536 |

Mechanical design

A	Metal through hollow shaft, 6 mm
B	Metal through hollow shaft, 8 mm
C	Metal through hollow shaft, 3/8"
D	Metal through hollow shaft, 10 mm
E	Metal through hollow shaft, 12 mm
F	Metal through hollow shaft, 1/2"
G	Metal through hollow shaft, 14 mm
H	Metal through hollow shaft, 15 mm
J	Metal through hollow shaft, 5/8"

Electrical interface (factory setting: output level TTL)

| P | 4.5 ... 32 V, TTL/HTL programmable |
| M | 4.5 ... 32 V, TTL/HTL programmable with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B) |

Connection type

A	M23 connector, 12-pin, radial
C	M12 connector, 8-pin, radial
K	8-core cable, universal 1.5 m [1]
L	8-core cable, universal 3 m [1]
M	8-core cable, universal 5 m [1]

Resolution
(factory set pulses per revolution with type B: 10000, with type A: 65536)

Always 5 digits in text, see "Pulses per revolution" on page 13

| D | F | S | 6 | 0 | | – | T | | | | | | | | | |

[1] The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

The following features can be programmed:

- Pulses per revolution from 1 ... 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- Zero pulse width mechanically 1° ... 359° using programming tool PGT-10-S (see accessories on page 25).
- Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- 0-SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 25).
- 0-SET function via PIN 7 of the M23 connector by applying U_s for at least 250 ms.

Type code for face mount flange and servo flange (highlighted in blue – standard types [1])),
not programmable

Type

E	Pulses per revolution 100 … 2048
B	Pulses per revolution 1 … 10000
A	Pulses per revolution 1 … 65536

Mechanical design

4	Face mount flange, 10 x 19 mm solid shaft
1	Servo flange, 6 x 10 mm solid shaft

Electrical interface

A	4.5 … 5.5 V, TTL/RS422
C	10 … 32 V, TTL/RS422
E	10 … 32 V, HTL/push pull
N	4.5 … 5.5 V, SIN/COS 1.0 V_{PP} (in combination with type B and 1024 pulses only)
U	4.5 … 5.5 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)
V	10 … 32 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)
W	10 … 32 V, HTL/push pull, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)

Connection type

A	M23 connector, 12-pin, radial
B	M23 connector, 12-pin, axial (no UL certification)
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial (no UL certification)
K	8-core cable, universal 1.5 m [2]
L	8-core cable, universal 3 m [2]
M	8-core cable, universal 5 m [2]

Resolution

Always 5 digits in text, see "Pulses per revolution" on page 13

D	F	S	6	0		–	S							

[1] The properties in the type code in blue and of the table "Pulses per revolution" are preferred types. Encoder versions compiled exclusively from preferred features are available in limited quantities from the warehouse with no minimum order quantity. They are therefore ideal for fast delivery worldwide.

[2] The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

Type code for blind hollow shaft (highlighted in blue – standard types [1]), **not programmable**

Type

E	Pulses per revolution 100 ... 2048
B	Pulses per revolution 1 ... 10000
A	Pulses per revolution 1 ... 65536

Mechanical design

A	Blind hollow shaft, 6 mm
B	Blind hollow shaft, 8 mm
C	Blind hollow shaft, 3/8"
D	Blind hollow shaft, 10 mm
E	Blind hollow shaft, 12 mm
F	Blind hollow shaft, 1/2"
G	Blind hollow shaft, 14 mm
H	Blind hollow shaft, 15 mm
J	Blind hollow shaft, 5/8"

Electrical interface

A	4.5 ... 5.5 V, TTL/RS422
C	10 ... 32 V, TTL/RS422
E	10 ... 32 V, HTL/push pull
N	4.5 ... 5.5 V, SIN/COS 1.0 V_{PP} (in combination with type B and 1024 pulses only)
U	4.5 ... 5.5 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)
V	10 ... 32 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)
W	10 ... 32 V, HTL/push pull, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)

Connection type

A	M23 connector, 12-pin, radial
B	M23 connector, 12-pin, axial (no UL certification)
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial (no UL certification)
K	8-core cable, universal 1.5 m [2]
L	8-core cable, universal 3 m [2]
M	8-core cable, universal 5 m [2]

Resolution

Always 5 digits in text, see "Pulses per revolution" on page 13

D	F	S	6	0		–	B								

[1] The properties in the type code in blue and of the table "Pulses per revolution" are preferred types. Encoder versions compiled exclusively from preferred features are available in limited quantities from the warehouse with no minimum order quantity. They are therefore ideal for fast delivery worldwide.

[2] The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

Type code for through hollow shaft (highlighted in blue – standard types [1]), **not programmable**

Type

E	Pulses per revolution 100 ... 2048
B	Pulses per revolution 1 ... 10000
A	Pulses per revolution 1 ... 65536

Mechanical design

A	Metal through hollow shaft, 6 mm
B	Metal through hollow shaft, 8 mm
C	Metal through hollow shaft, 3/8"
D	Metal through hollow shaft, 10 mm
E	Metal through hollow shaft, 12 mm
F	Metal through hollow shaft, 1/2"
G	Metal through hollow shaft, 14 mm
H	Metal through hollow shaft, 15 mm
J	Metal through hollow shaft, 5/8"

Electrical interface

A	4.5 ... 5.5 V, TTL/RS422
C	10 ... 32 V, TTL/RS422
E	10 ... 32 V, HTL/push pull
N	4.5 ... 5.5 V, SIN/COS 1.0 V_{PP} (in combination with type B and 1024 pulses only)
U	4.5 ... 5.5 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)
V	10 ... 32 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)
W	10 ... 32 V, HTL/push pull, with 0-set function on pin 7 of the M23 connector. (in combination with type B or A and connection type A or B only)

Connection type

A	M23 connector, 12-pin, radial
C	M12 connector, 8-pin, radial
K	8-core cable, universal 1.5 m [2]
L	8-core cable, universal 3 m [2]
M	8-core cable, universal 5 m [2]

Resolution

Always 5 digits in text, see "Pulses per revolution" on page 13

D	F	S	6	0		–	T								

[1] The properties in the type code in blue and of the table "Pulses per revolution" are preferred types. Encoder versions compiled exclusively from preferred features are available in limited quantities from the warehouse with no minimum order quantity. They are therefore ideal for fast delivery worldwide.

[2] The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

Pulses per revolution (highlighted in blue – standard types [1])

Pulses per revolution [2]	E	B	A
	00100	00100	00100
	00200	00200	00200
	00250	00250	00250
	00256	00300	00300
	00314	00314	00314
	00360	00360	00360
	00500	00500	00500
	00512	00512	00512
	00720	00720	00720
	01000	01000	01000
	01024	01024	01024
	01250	01250	01250
	02000	02000	02000
	02048	02048	02048
		02500	02500
		03600	03600
		04000	04000
		04096	04096
		05000	05000
		07200	07200
		08192	08192
		10000	10000
			16384
			32768
			65536
		Others on request	Others on request

[1] The properties in the type code in blue and of the table "Pulses per revolution" are preferred types. Encoder versions compiled exclusively from preferred features are available in limited quantities from the warehouse with no minimum order quantity. They are therefore ideal for fast delivery worldwide.

[2] The electrical interface N (Sin/Cox 1.0 V_{PP}) can only be ordered with 1024 pulses per revolution.

Dimensional drawings

dimensions in mm (inch)

Face mount flange

Cable outlet
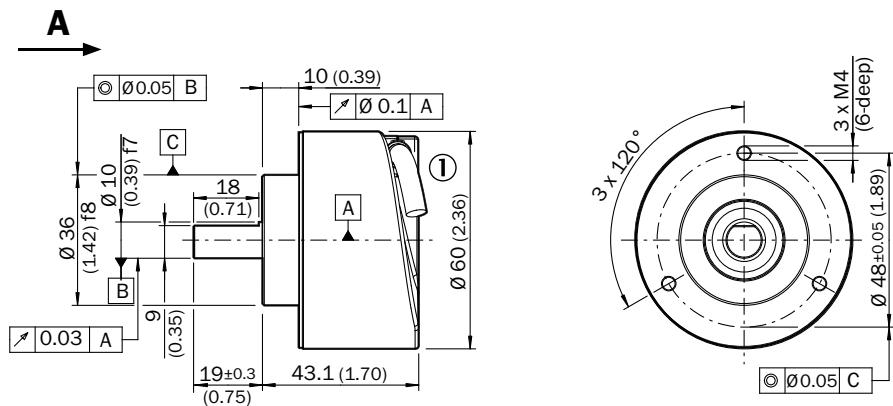
General tolerances as per DIN ISO 2768-mk
① Cable diameter = 5.6 ± 0.2 mm; bend radius R = 30 mm

Radial connector outlet M12 and M23

General tolerances as per DIN ISO 2768-mk

Axial connector outlet M12 and M23

Connector orientation

X1   X2
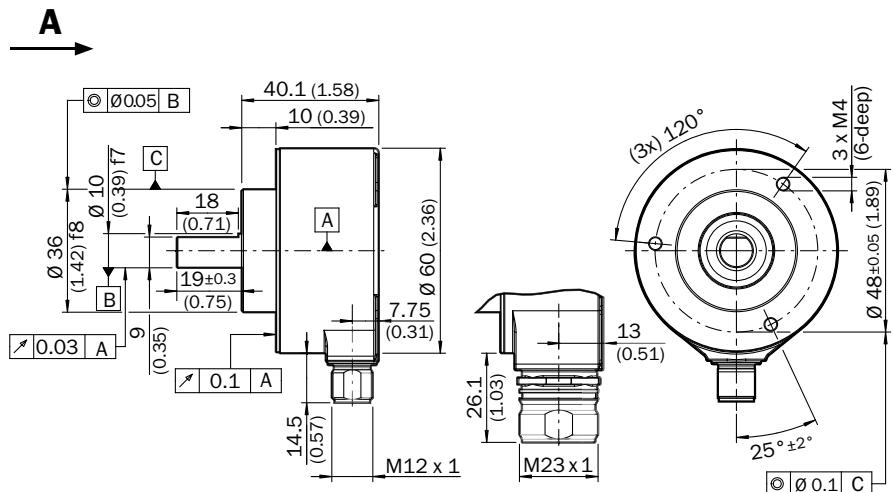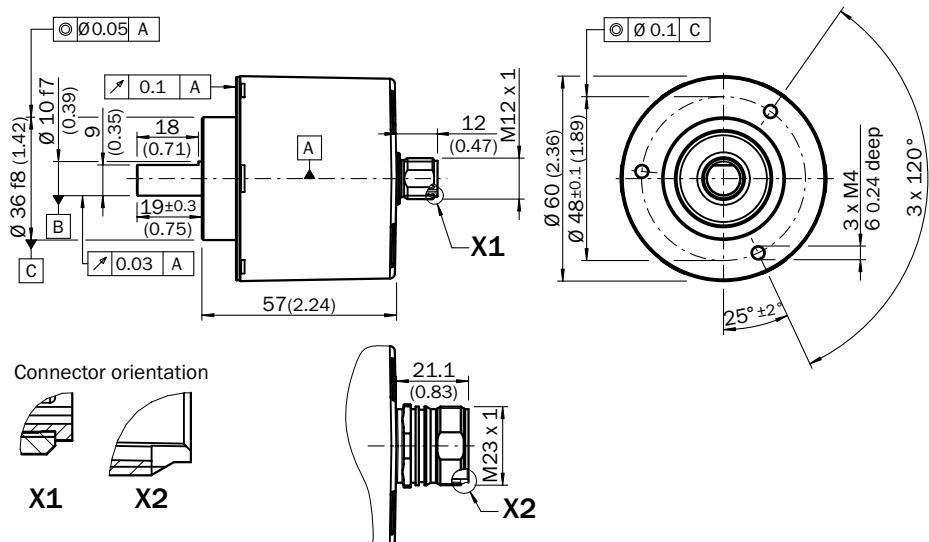
General tolerances as per DIN ISO 2768-mk

Servo flange

Cable outlet
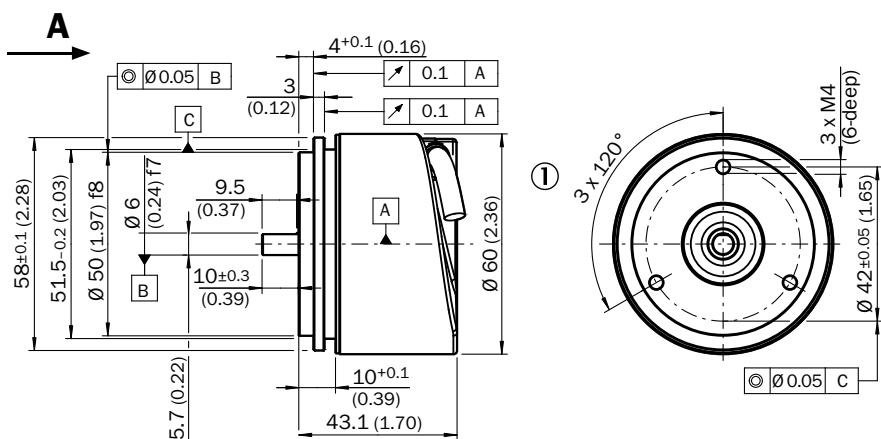
General tolerances as per DIN ISO 2768-mk

① Cable diameter = 5.6 ± 0.2 mm; bend radius R = 30 mm

Radial connector outlet M12 and M23

General tolerances as per DIN ISO 2768-mk

Axial connector outlet M12 and M23

Connector orientation

X1   X2
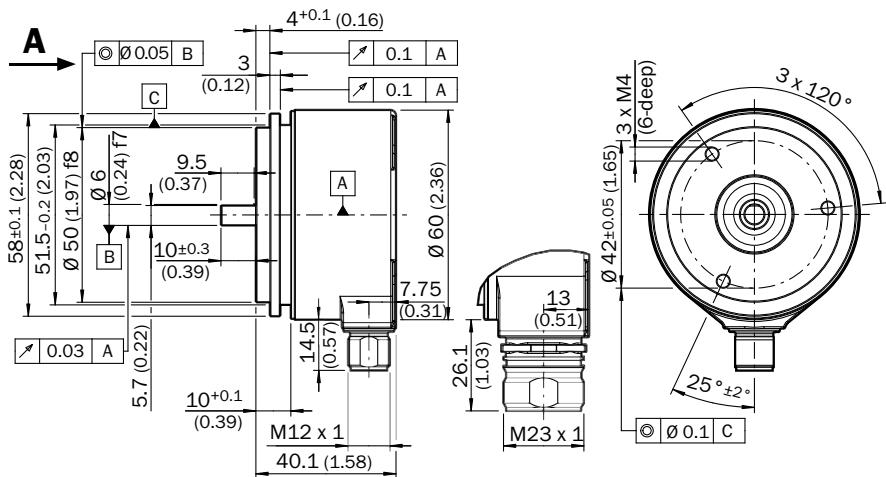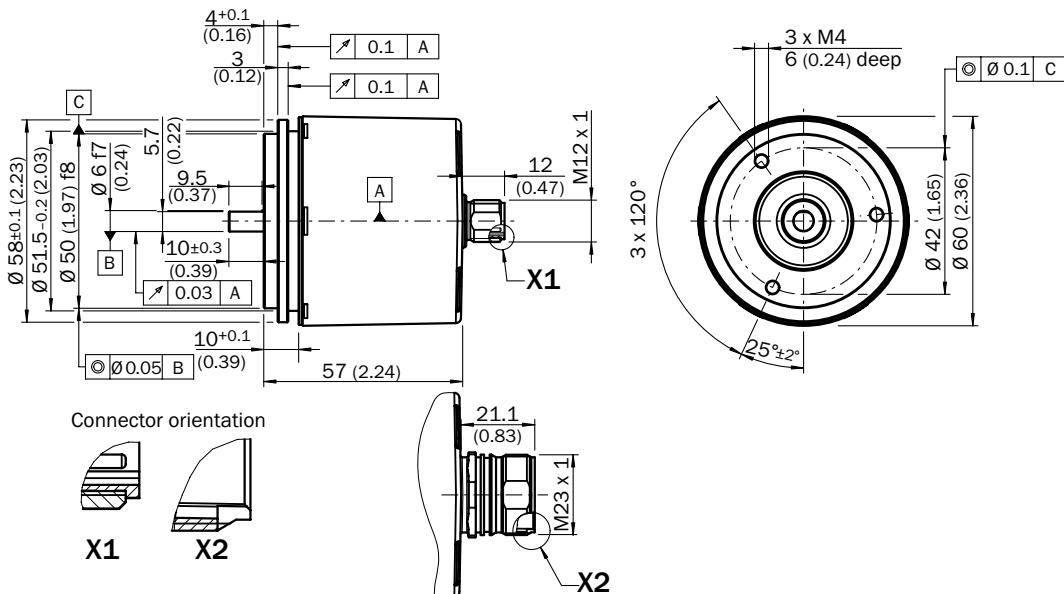
General tolerances as per DIN ISO 2768-mk

Mounting suggestion for small servo clamp part no. 2029166

3 x 120°

Ø 68 (2.68)
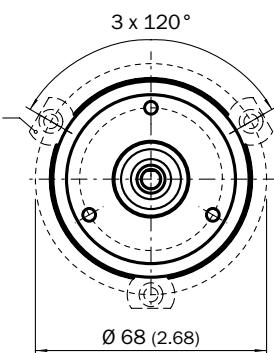
Mounting suggestion for half-shell servo clamp part no. 2029165

4 x 90°

Ø 71 (2.80)
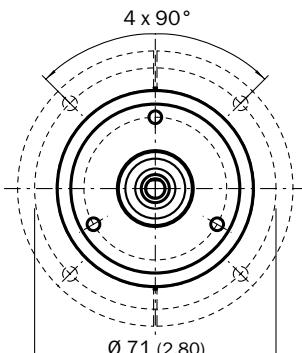
Blind hollow shaft

Cable outlet
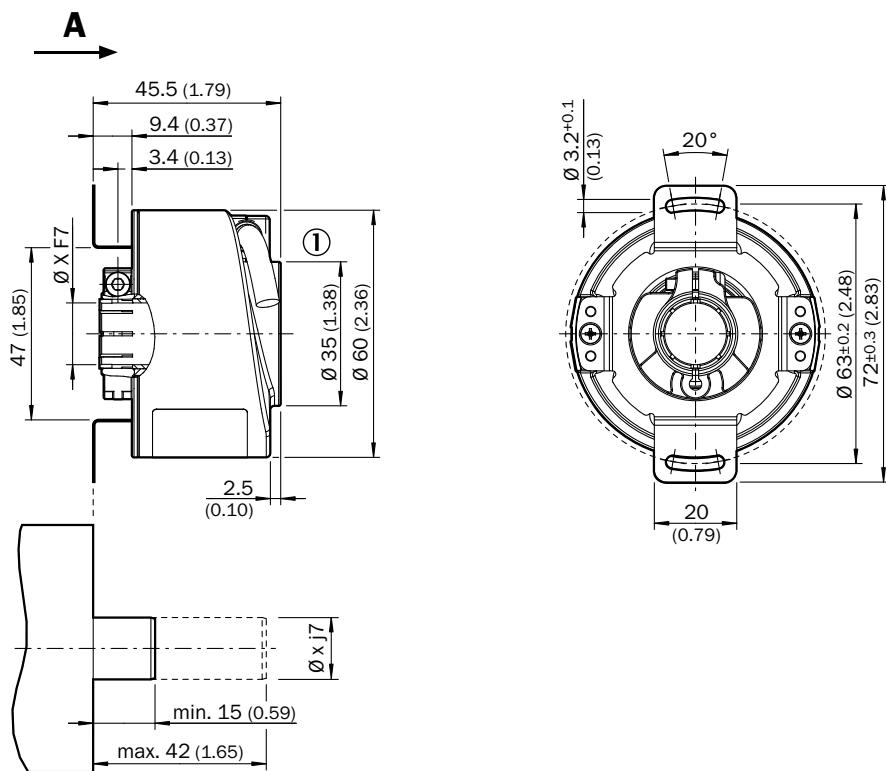
General tolerances as per DIN ISO 2768-mk

① Cable diameter = 5.6 ± 0.2 mm; bend radius R = 30 mm
XF7 = hollow shaft diameter, see table below
xj7 = shaft diameter, on the customer side

Diameter XF7
Blind hollow shaft 6 mm
Blind hollow shaft 8 mm
Blind hollow shaft 3/8"
Blind hollow shaft 10 mm
Blind hollow shaft 12 mm
Blind hollow shaft 1/2"
Blind hollow shaft 14 mm
Blind hollow shaft 15 mm
Blind hollow shaft 5/8"

Radial connector outlet M12 and M23
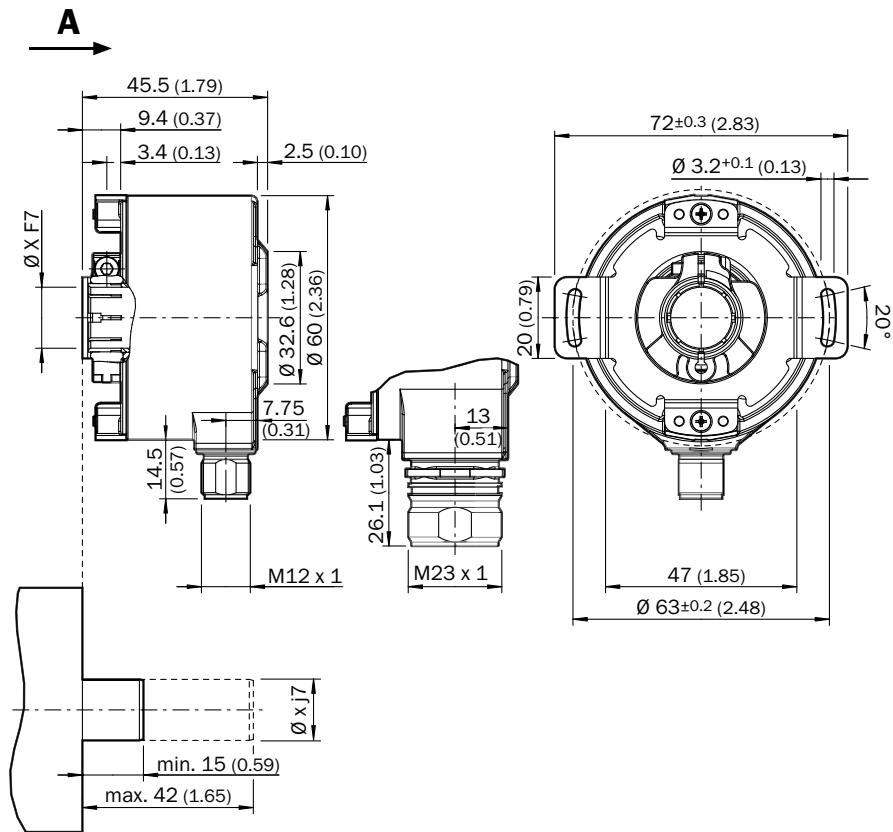
General tolerances as per DIN ISO 2768-mk

XF7 = hollow shaft diameter, see table below

xj7 = shaft diameter, on the customer side

Diameter XF7
Blind hollow shaft 6 mm
Blind hollow shaft 8 mm
Blind hollow shaft 3/8"
Blind hollow shaft 10 mm
Blind hollow shaft 12 mm
Blind hollow shaft 1/2"
Blind hollow shaft 14 mm
Blind hollow shaft 15 mm
Blind hollow shaft 5/8"

Axial connector outlet M12 and M23
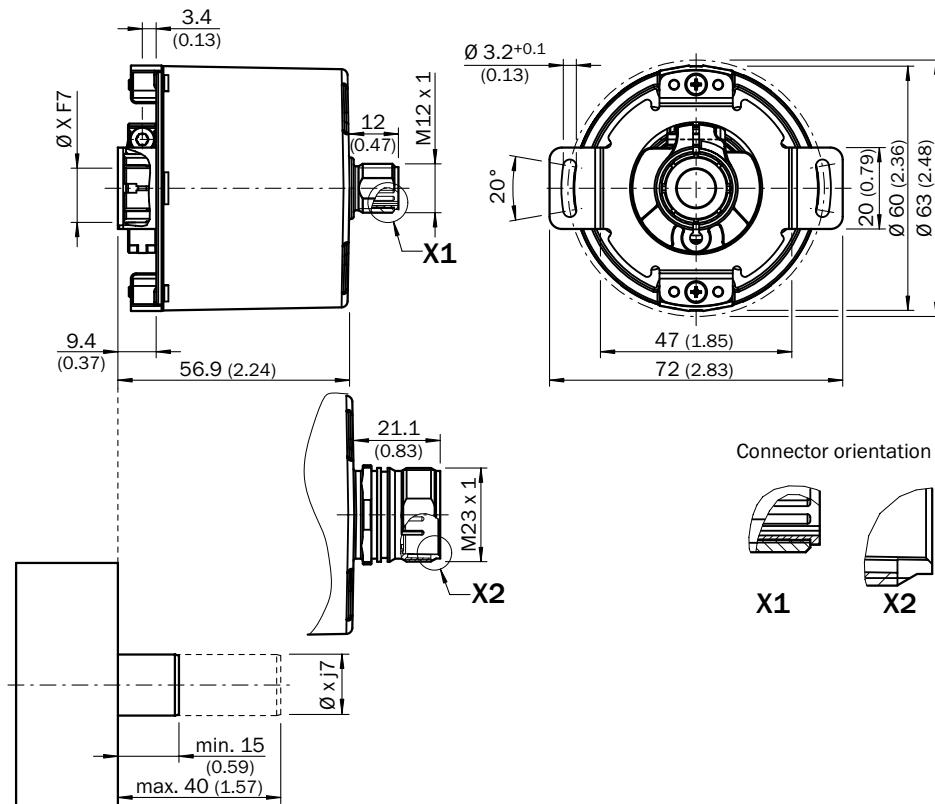
Connector orientation

X1 **X2**

Customer side

General tolerances as per DIN ISO 2768-mk

XF7 = hollow shaft diameter, see table below
xj7 = shaft diameter, on the customer side

Diameter XF7
Blind hollow shaft 6 mm
Blind hollow shaft 8 mm
Blind hollow shaft 3/8"
Blind hollow shaft 10 mm
Blind hollow shaft 12 mm
Blind hollow shaft 1/2"
Blind hollow shaft 14 mm
Blind hollow shaft 15 mm
Blind hollow shaft 5/8"

Through hollow shaft

Metal, cable outlet
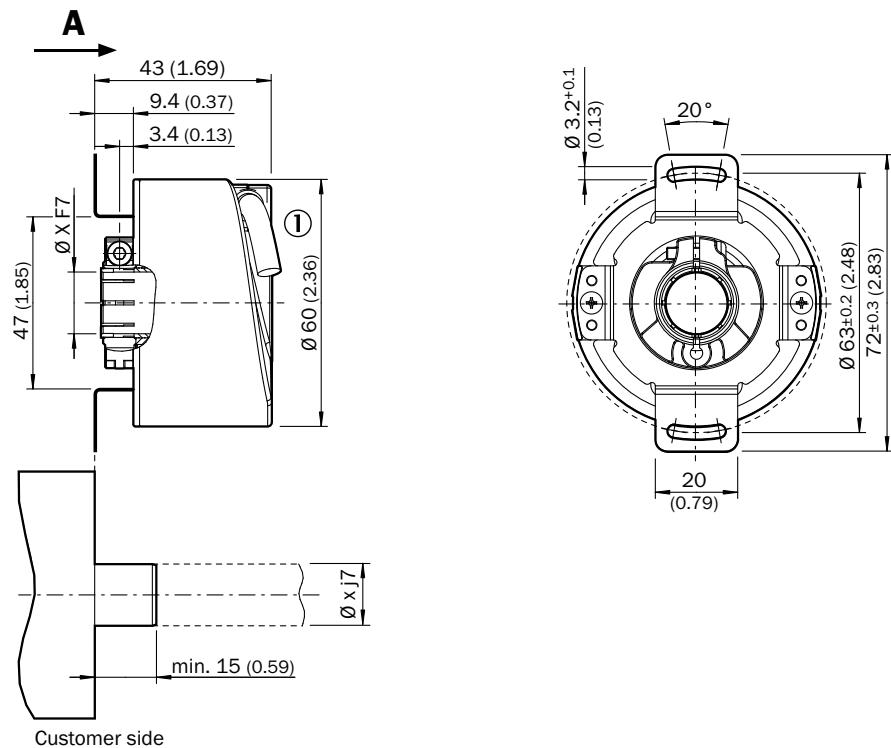
Customer side

General tolerances as per DIN ISO 2768-mk

① Cable diameter = 5.6 ± 0.2 mm; bend radius R = 30 mm

XF7 = hollow shaft diameter, see table below

xj7 = shaft diameter, on the customer side

Diameter XF7
Blind hollow shaft 6 mm
Blind hollow shaft 8 mm
Blind hollow shaft 3/8"
Blind hollow shaft 10 mm
Blind hollow shaft 12 mm
Blind hollow shaft 1/2"
Blind hollow shaft 14 mm
Blind hollow shaft 15 mm
Blind hollow shaft 5/8"

Metal, radial connector outlet M12 and M23
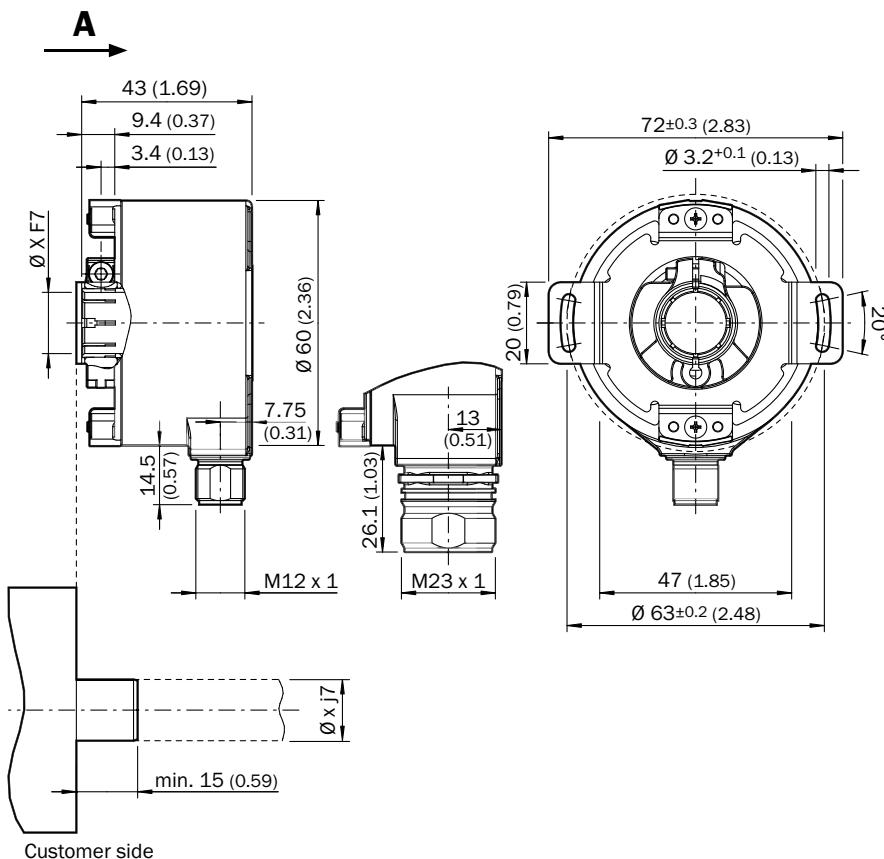
Customer side

General tolerances as per DIN ISO 2768-mk

XF7 = hollow shaft diameter, see table below

xj7 = shaft diameter, on the customer side

Diameter XF7
Blind hollow shaft 6 mm
Blind hollow shaft 8 mm
Blind hollow shaft 3/8"
Blind hollow shaft 10 mm
Blind hollow shaft 12 mm
Blind hollow shaft 1/2"
Blind hollow shaft 14 mm
Blind hollow shaft 15 mm
Blind hollow shaft 5/8"

PIN and core assignment

8-core cable

View of M12 device connector on encoder
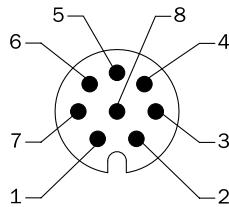
View of M23 device connector on encoder
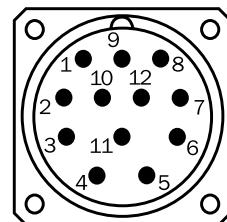
PIN, 8-pin, M12 connector	PIN, 12-pin, M23 connector	Core colors of encoders with cable outlet	TTL/HTL signal	SIN/COS 1,0 V$_{PP}$	Explanation
1	6	Brown	$\overline{A}$	COS–	Signal cable
2	5	White	A	COS+	Signal cable
3	1	Black	$\overline{B}$	SIN–	Signal cable
4	8	Pink	B	SIN+	Signal cable
5	4	Yellow	$\overline{Z}$	$\overline{Z}$	Signal cable
6	3	Lilac	Z	Z	Signal cable
7	10	Blue	GND	GND	Ground connection of the encoder
8	12	Red	+U$_S$	+U$_S$	Supply voltage (volt-free to housing)
–	9	–	N.C.	N.C.	Not assigned
–	2	–	N.C.	N.C.	Not assigned
–	11	–	N.C.	N.C.	Not assigned
–	7 [1]	–	0-SET [1]	N.C.	Zeropulse Teach [1]
Shield	Shield	Shield	Shield	Shield	Shield connected to housing on side of encoder. Connected to ground on side of control.

[1] For electrical interfaces only: M, U, V, W with 0-SET function on PIN 7 on M23 plug. The 0-SET input is used to set the zero pulse on the current shaft position. If the 0-SET input is applied to U$_S$ for longer than 250 ms, after it has was open for at least 1,000 ms or applied to GND, the current shaft position is assigned the zero pulse signal "Z".

Interfaces

Signal outputs for electrical interfaces TTL and HTL
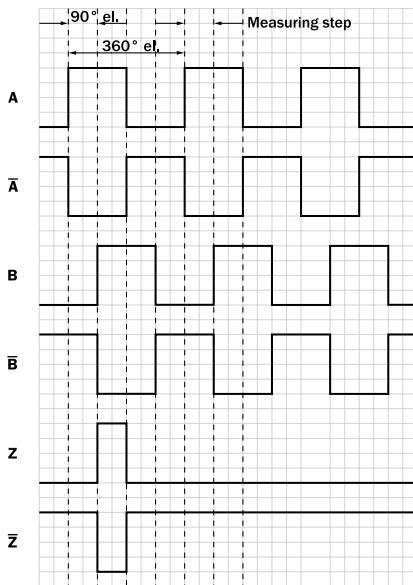
Cw looking towards the encoder shaft pointing towards "A" , see dimensional drawing.

Supply voltage	Output
4.5 ... 5.5 V	TTL
10 ... 32 V	TTL
10 ... 32 V	HTL

Electrical zero pulse width 90°, 180° or 270° programmable. Width of the zero pulse in relation to a pulse period.

Cw looking towards the encoder shaft pointing towards "A", see dimensional drawing.

Supply voltage	Output
4.5 ... 32 V	HTL/TTL programmable

Mechanical zero pulse width 1° to 359° programmable. Width of the zero pulse in relation to a mechanical revolution of the shaft.

Electrical interfaces SIN/COS 1.0 V$_{PP}$

Power supply	Output
4.5 ... 5.5 V	Sine 0.5 V$_{pp}$

Signal **before** differential generation at load 120 Ω and U$_S$ = 5 V

Signal diagram for clockwise rotation of the shaft looking in direction "A" (shaft)
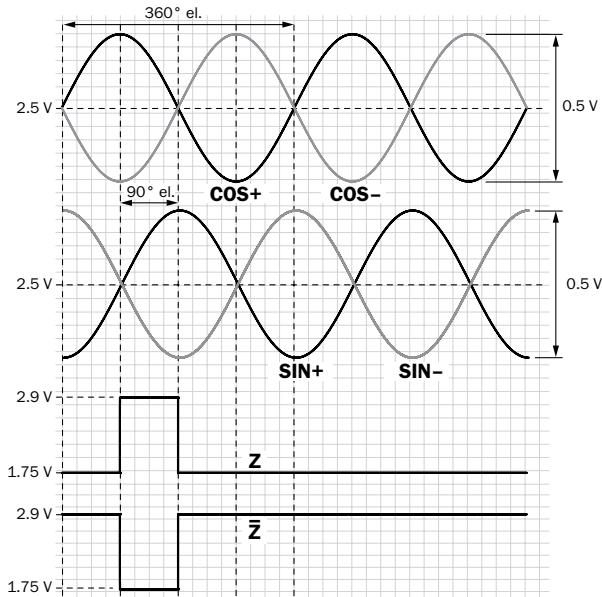
Interface signals Sin+, SIN−, COS+, COS−	Signal before differential generation at load 120 Ω	Signal offset
Analog differential	0.5 V$_{pp}$ ± 20 %	2.5 V ± 10 %

Interface signals Z, $\overline{Z}$	Signal before differential generation at load 120 Ω
Digital differential	Low: 1.75 V ± 15 %; High: 2.9 V ± 15 %

Signal **after** differential generation at load 120 Ω and U$_S$ = 5 V

Signal diagram for clockwise rotation of the shaft looking in direction "A" (shaft)
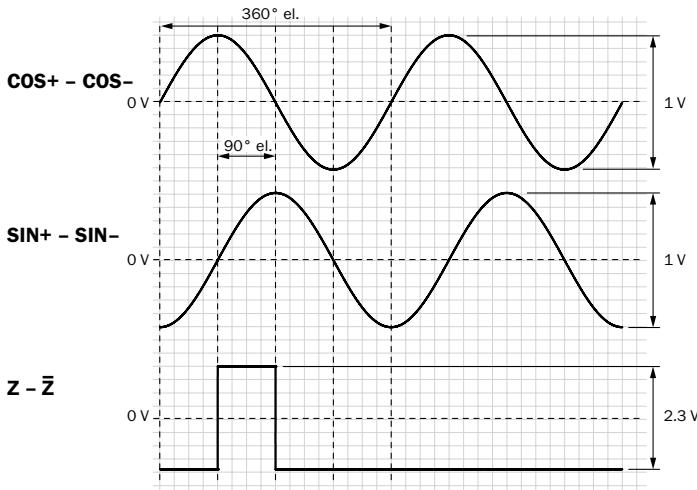
Accessories

Programming Tools

	Description	Model name	Part no.
	Programming tool for connection to standard PC or notebook via USB port	PGT-08-S	1036616
	The PGT-10-S is an intuitively operated standalone programming device for SICK incremental encoders. Its low weight and compact dimensions make it portable and usable everywhere.	PGT-10-S	1052967

Adapter cable for programming tools

The following adapter cables are required to program the SICK incremental encoders.

	Description	Model name	Part no.
	Adapter cable for incremental programming tool with SUB-D 9-pin cable plug and M12 8-pin cable socket, pre-wired with 8-core cable, 4 x 2 x 0.08 mm², shielded, suitable for incremental encoder with M12 plug connector	DSL-2D08-G0M5AC3	2046579
	Adapter cable for incremental programming tool with SUB-D 9-pin cable plug and M23 12-pin cable socket, pre-wired with 8-core cable, 4 x 2 x 0.08 mm², shielded, suitable for incremental encoder with M23 plug connector	DSL-3D08-G0M5AC3	2046580
	Adapter cable for incremental programming tool with SUB-D 9-pin cable plug, shielded, suitable for incremental encoder with cable outlet	DSL-0D08-G0M5AC3	2061739

WARNING: Programming of the incremental encoders using the adapter cables for the absolute encoders will destroy the incremental encoders. Please ensure correct use!

Plug connectors and cables

M12 screw-in system

- Straight, shielded, convertible (on adapter)

Contacts	Cable diameter	Description	Model name	Part no.
8	4 ... 8 mm	Cable plug, M12, 8-pin, straight, shielded, suitable for cable diameter 4 - 8 mm	STE-1208-GA01	6044892
		Cable socket, M12, 8-pin, straight, shielded, suitable for cable diameter 4 - 8 mm	DOS-1208-GA01	6045001

STE-1208-GA01
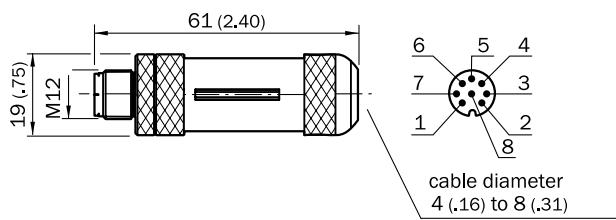
DOS-1208-GA01
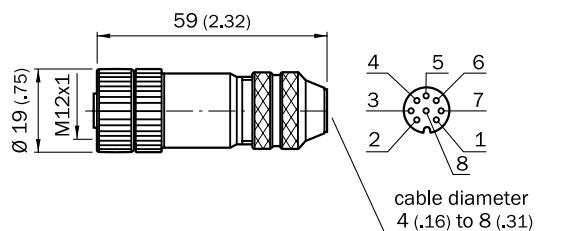
- Straight, shielded

Description	Cable length	Model name	Part no.
Cable socket, 8-pin, straight, pre-wired with 8-core cable, 4 x 2 x 0.25 mm², shielded, cable diameter 7.0 mm	2.0 m	DOL-1208-G02MAC1	6032866
	5.0 m	DOL-1208-G05MAC1	6032867
	10.0 m	DOL-1208-G10MAC1	6032868
	20.0 m	DOL-1208-G20MAC1	6032869

DOL-1208-GxxMAC1
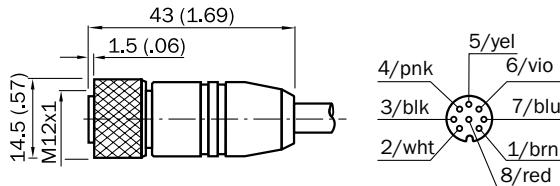
Cables

• With shield

Cores	Cable diameter	Description	Cable length	Model name	Part no.
8	5.6 mm	Data cable by the meter 4 x 2 x 0.15 mm² with shielding, diam. 5.6 mm	Bulk goods	LTG-2308-MWENC	6027529
		Cables including seal, 4 x 2 x 0.15 mm² for incremental encoder with universal cable outlet, with shielding, diam. 5.6 mm	0.5 m	DOL-0J08-G0M5AA3	2046873
			1.5 m	DOL-0J08-G1M5AA3	2046874
			3.0 m	DOL-0J08-G03MAA3	2046875
			5.0 m	DOL-0J08-G05MAA3	2046876
			10.0 m	DOL-0J08-G10MAA3	2046877
11	7.5 mm	Data cable by the meter 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm² with shielding, diam. 7.5 mm	Bulk goods	LTG-2411-MW	6027530
12	7.8 mm	Data cable by the meter 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 2 x 0.14 mm² with shielding, suitable for drag chain, diam. 7.8 mm	Bulk goods	LTG-2512-MW	6027531
		Data cable by the meter 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 2 x 0.14 mm² with shielding, suitable for drag chain, UV and salt water resistant, diam. 7.8 mm	Bulk goods	LTG-2612-MW	6028516

Attention!

The flexible wires twisted in pairs must be assigned in accordance with the signals.

White/Brown = A/$\overline{A}$
Lilac/Yellow = Z/$\overline{Z}$
Pink/Black = B/$\overline{B}$
Red/Blue = preferably U_s and GND

DOL-0J08-GxxxAA3
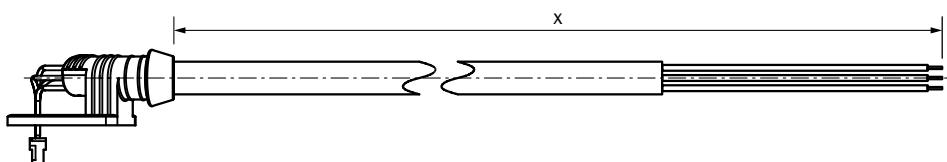
Round screw system M23

- Straight, shielded

Description	Cable length	Model name	Part no.
M23 cable plug, 12-pin, straight, 8-core cable, including seal, 4 x 2 x 0.15 mm², with shielding, cable diameter 5.6 mm	0.35 m	STL-2312-GM35AA3	2061621
	1.0 m	STL-2312-G01MAA3	2061622
	2.0 m	STL-2312-G02MAA3	2061504

STL-2312-GM35AA3
STL-2312-G01MAA3
STL-2312-G02MAA3
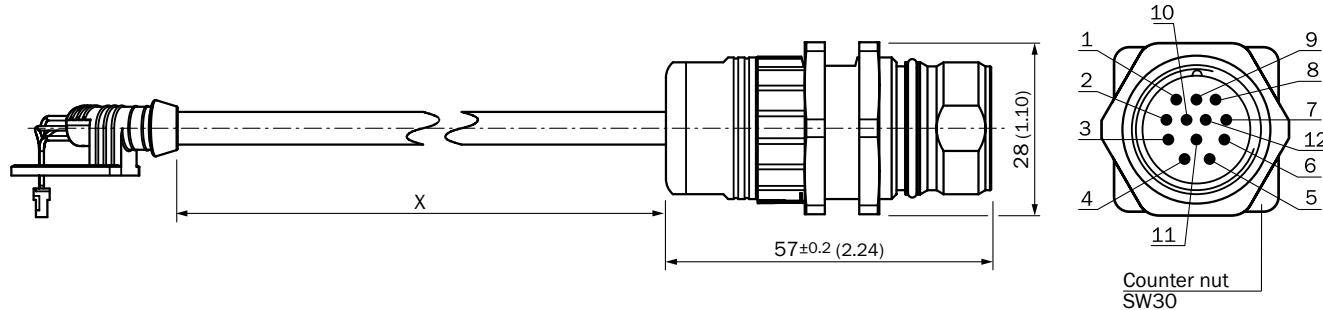
PIN allocation connector M23

PIN	Signal TTL, HTL	Signal sine 1.0 V_{pp}
1	$\overline{B}$	SIN–
2	Not connected	Not connected
3	Z	Z
4	$\overline{Z}$	$\overline{Z}$
5	A	COS+
6	$\overline{A}$	COS–
7	Not connected	Not connected
8	B	SIN+
9	Not connected	Not connected
10	GND	GND
11	Not connected	Not connected
12	U_S	U_S
Shield	Shield [1]	Shield [1]

Attention!

The flexible wires twisted in pairs must be assigned in accordance with the signals.

White/Brown = A/$\overline{A}$ or COS+/COS–
Lilac/Yellow = Z/$\overline{Z}$
Pink/Black = B/$\overline{B}$ or SIN+/ SIN–
Red/Blue = preferably U_S and GND

[1] Shield connected to housing on side of encoder. Connected to ground on side of control.

Attention! In combination with the electrical interfaces A, C, E and P only.

M23 screw-in system

• Straight, shielded

Contacts	Description	Model name	Part no.
12	Cable plug, M23, 12-pin, straight, shielded, suitable for cable diameter 5.5 - 10.5 mm	STE-2312-G	6027537
	Cable socket, M23, 12-pin, straight, shielded, suitable for cable diameter 5.5 - 10.5 mm	DOS-2312-G	6027538

STE-2312-G
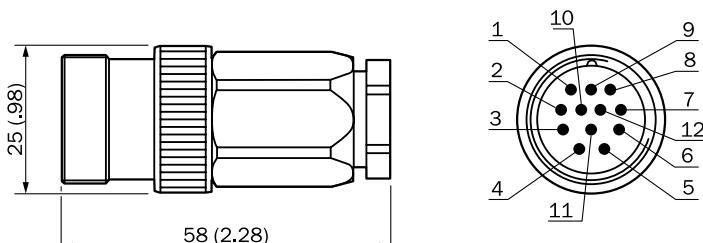
General tolerances as per DIN ISO 2768-mk

DOS-2312-G
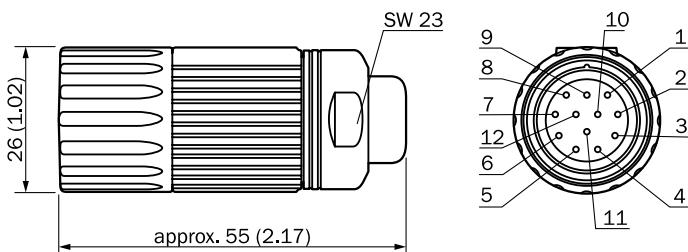
General tolerances as per DIN ISO 2768-mk

Description	Cable length	Model name	Part no.
Cable socket, M23, 12-pin, straight, pre-wired with 11-core cable, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², shielded, cable diameter 7.8 mm [1]	2.0 m	DOL-2312-G02MLA3	2030682
	7.0 m	DOL-2312-G07MLA3	2030685
	10.0 m	DOL-2312-G10MLA3	2030688
	15.0 m	DOL-2312-G15MLA3	2030692
	20.0 m	DOL-2312-G20MLA3	2030695
	25.0 m	DOL-2312-G25MLA3	2030699
	30.0 m	DOL-2312-G30MLA3	2030702

[1] Warning! Only in combination with the electrical interfaces A, C, E and P.

Description	Cable length	Model name	Part no.
Cable socket, M23, 12-pin, straight, 11-core cable, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², shielded, cable diameter 7.8 mm [1]	1.5 m	DOL-2312-G1M5MA3	2029212
	3.0 m	DOL-2312-G03MMA3	2029213
	5.0 m	DOL-2312-G05MMA3	2029214
	10.0 m	DOL-2312-G10MMA3	2029215
	20.0 m	DOL-2312-G20MMA3	2029216
	30.0 m	DOL-2312-G30MMA3	2029217

[1] Warning! Only in combination with the electrical interfaces A, C, E and P.

Description	Cable length	Model name	Part no.
Cable socket, M23, 12-pin, straight, 11-core cable, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², shielded, cable diameter 7.8 mm [1]	2.0 m	DOL-2312-G02MLD1	2062202
	7.0 m	DOL-2312-G07MLD1	2062203
	10.0 m	DOL-2312-G10MLD1	2062204
	15.0 m	DOL-2312-G15MLD1	2062205
	20.0 m	DOL-2312-G20MLD1	2062206
	25.0 m	DOL-2312-G25MLD1	2062207
	30.0 m	DOL-2312-G30MLD1	2062208

[1] Warning! Only in combination with the electrical interfaces U, V, W and M.

Description	Cable length	Model name	Part no.
Cable socket, M23, 12-pin, straight, pre-wired with 12-core cable, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², shielded, cable diameter 7.8 mm, suitable for drag chain [1]	1.5 m	DOL-2312-G1M5MD1	2062240
	3.0 m	DOL-2312-G03MMD1	2062243
	5.0 m	DOL-2312-G05MMD1	2062244
	10.0 m	DOL-2312-G10MMD1	2062245
	20.0 m	DOL-2312-G20MMD1	2062246
	30.0 m	DOL-2312-G30MMD1	2062247

[1] Warning! Only in combination with the electrical interfaces U, V, W and M.

Shaft adaptation

Couplings

- Bellow coupling, max. shaft offset radially ± 0.3 mm, axially 0.4 mm, angle ± 4 degrees, torsion spring stiffness of 120 Nm/rad, stainless steel bellow, aluminum hub.

Description	Model name	Part no.
Bellows coupling with hole diameter combination 6 mm x 6 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 4°, torsion spring stiffness 130 Nm/rad, material: stainless steel bellows, aluminum hub	KUP-0606-B	5312981
Bellows coupling with hole diameter combination 6 mm x 10 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 4°, torsion spring stiffness 130 Nm/rad; material: stainless steel bellows, aluminum hub	KUP-0610-B	5312982
Bellows coupling with hole diameter combination 10 mm x 10 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 4°, torsion spring stiffness 130 Nm/rad; material: stainless steel bellows, aluminum hub	KUP-1010-B	5312983
Bellows coupling with hole diameter combination 10 mm x 12 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 4°, torsion spring stiffness 130 Nm/rad; material: stainless steel bellows, aluminum hub	KUP-1012-B	5312984

KUP-0606-B
KUP-0610-B
KUP-1010-B
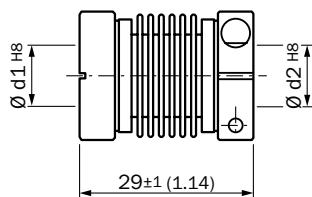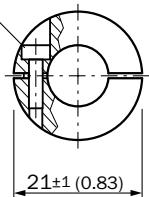
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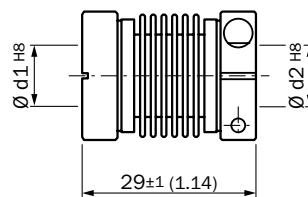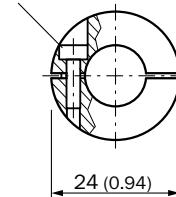
- Spring-disc coupling, max. shaft offset radially ± 0.3 mm, axially 0.4 mm, angle ± 2.5 degrees, torsion spring stiffness of 50 Nm/rad, aluminum flange, plastic spring washer glass-fiber reinforced.

Description	Model name	Part no.
Spring washer coupling with hole diameter combination 6 mm x 10 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 2.5°, torsion spring stiffness 30 Nm/rad; material: aluminum flange, glass-fiber reinforced polyamide membrane and hardened steel coupling pin	KUP-0610-F	5312985
Spring washer coupling with hole diameter combination 10 mm x 10 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 2.5°, torsion spring stiffness 30 Nm/rad; material: aluminum flange, glass-fiber reinforced polyamide membrane and hardened steel coupling pin	KUP-1010-F	5312986

KUP-0610-F
KUP-1010-F
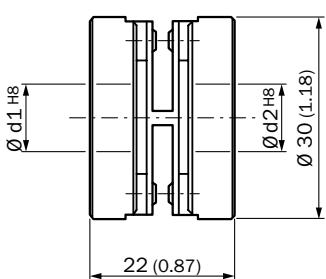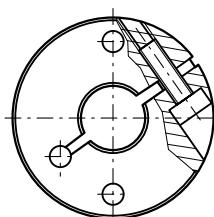
Insulating shaft connection

	Outside diameter	Inside diameter	Model name	Part no.
	10 mm	8 mm	Insulating sleeve 8 x 10 PEEK	2065642
	12 mm	10 mm	Insulating sleeve 10 x 12 PEEK	2064571
	14 mm	12 mm	Insulating sleeve 12 x 14 PEEK	2064573
	15 mm	12.7 mm	Insulating sleeve 12,7 x 15 PEEK	2064572

Insulating sleeve 8 x 10 PEEK
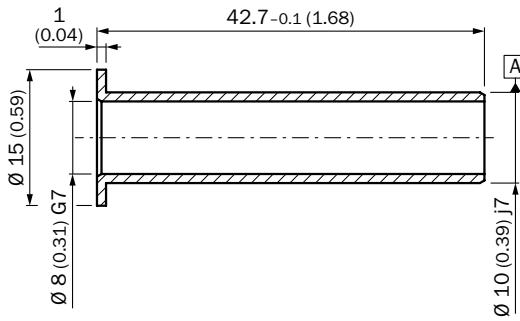
Insulating sleeve 10 x 12 PEEK
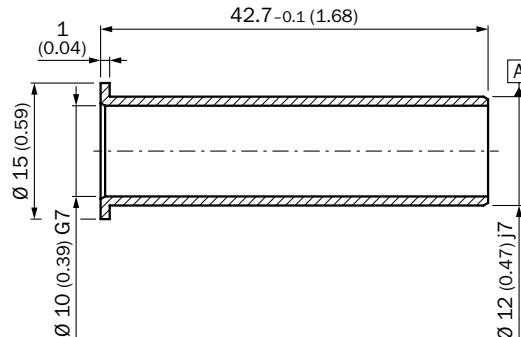
Insulating sleeve 12 x 14 PEEK
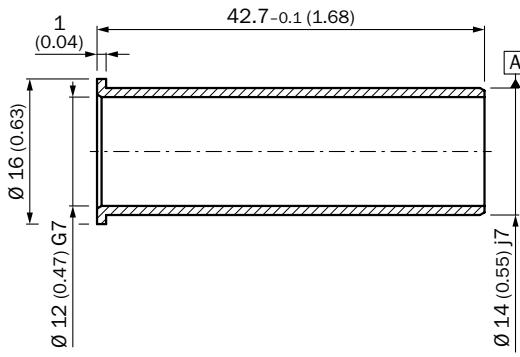
Insulating sleeve 12,7 x 15 PEEK
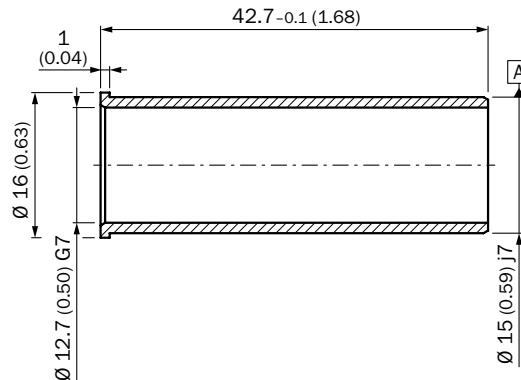
The diameter of the shaft provided by the customer must be in fit j7.

Clamping ring

Description	Model name	Part no.
Clamping ring metal, accessory for hollow shaft encoder	BEF-KR-M	2064709

Torque support

Description	Model name	Part no.
Standard torque support	BEF-DS00XFX	2056812
Torque support, one-sided, 81 mm long with slot	BEF-DS01DFS/VFS	2047428
Torque support, one-sided, 179 mm long with slots	BEF-DS02DFS/VFS	2047430
Torque support, one-sided, 248 mm long with slots	BEF-DS03DFS/VFS	2047431

BEF-DS00XFX
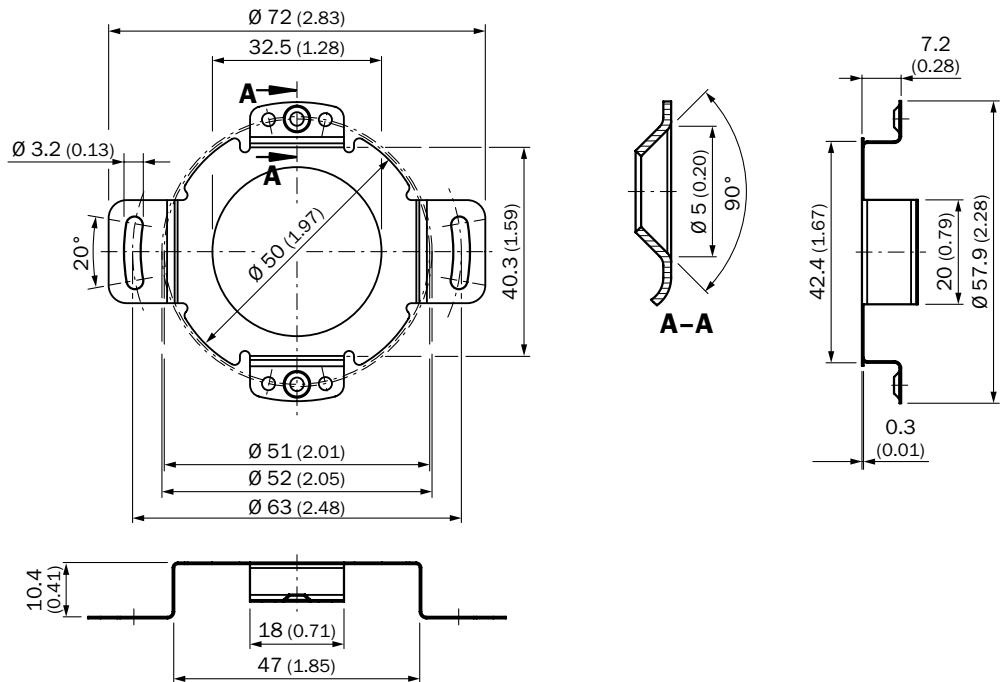
BEF-DS01DFS/VFS

BEF-DS02DFS/VFS

A-A
5:1

BEF-DS03DFS/VFS

A-A
5:1
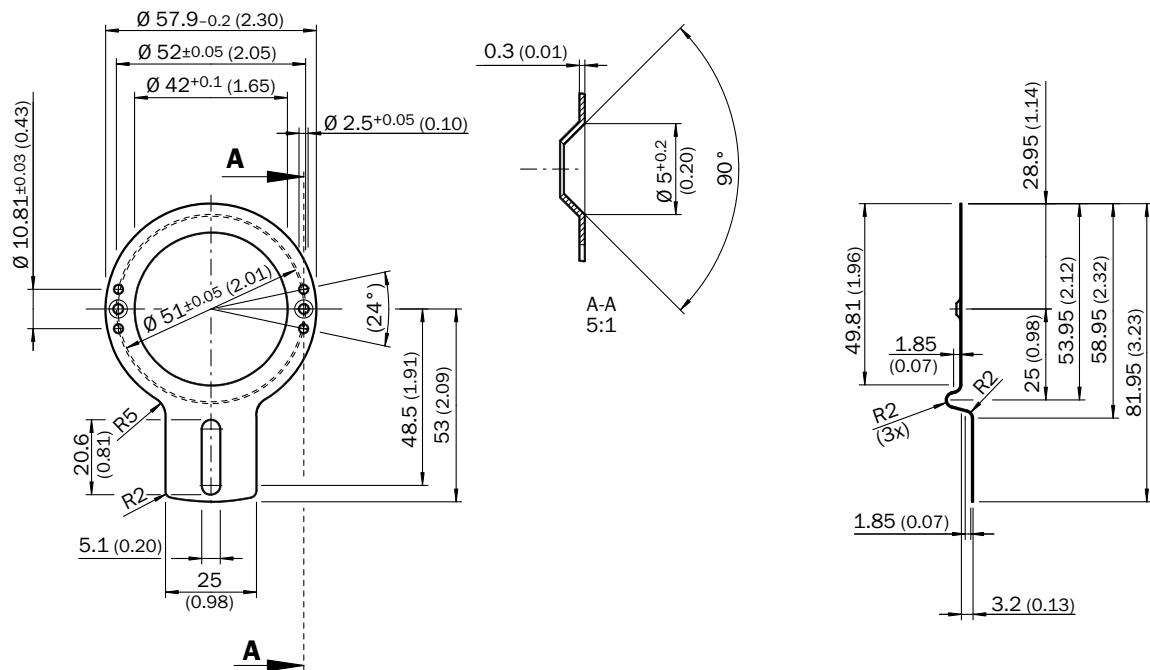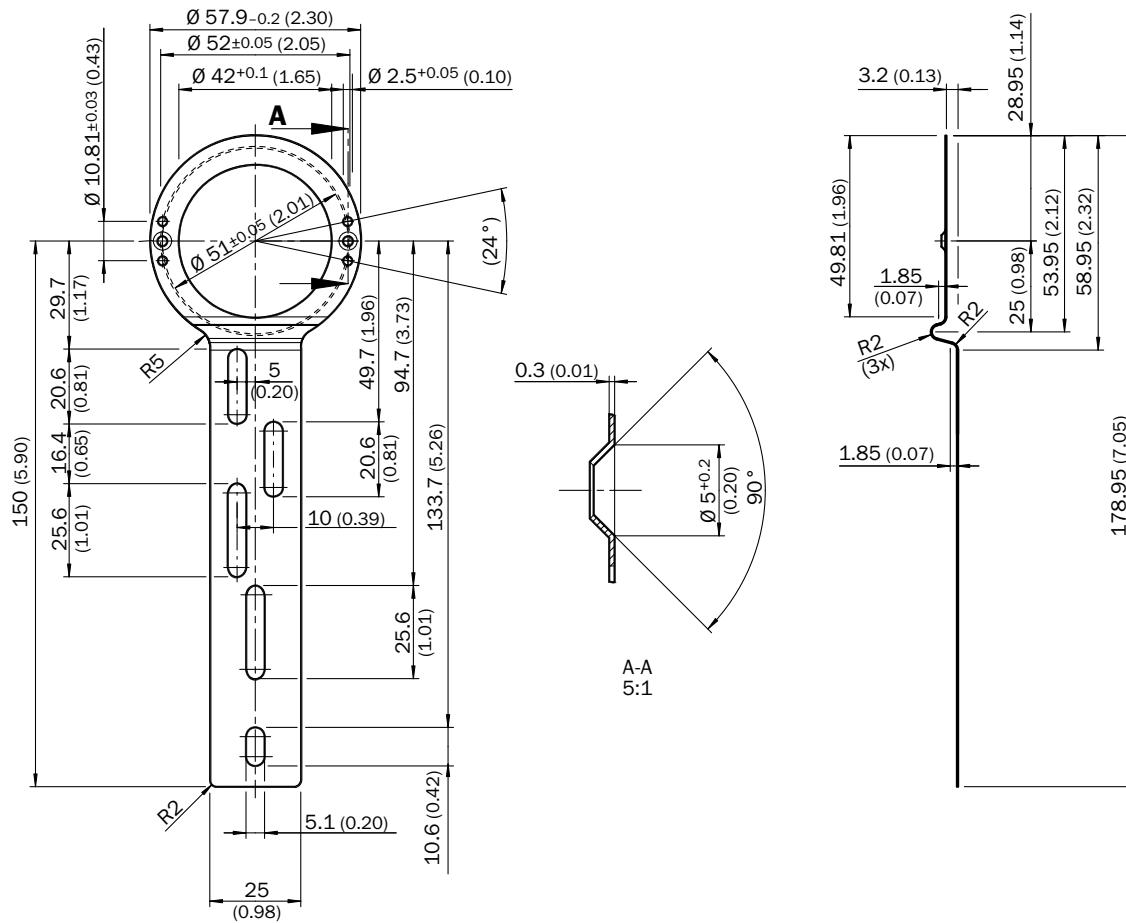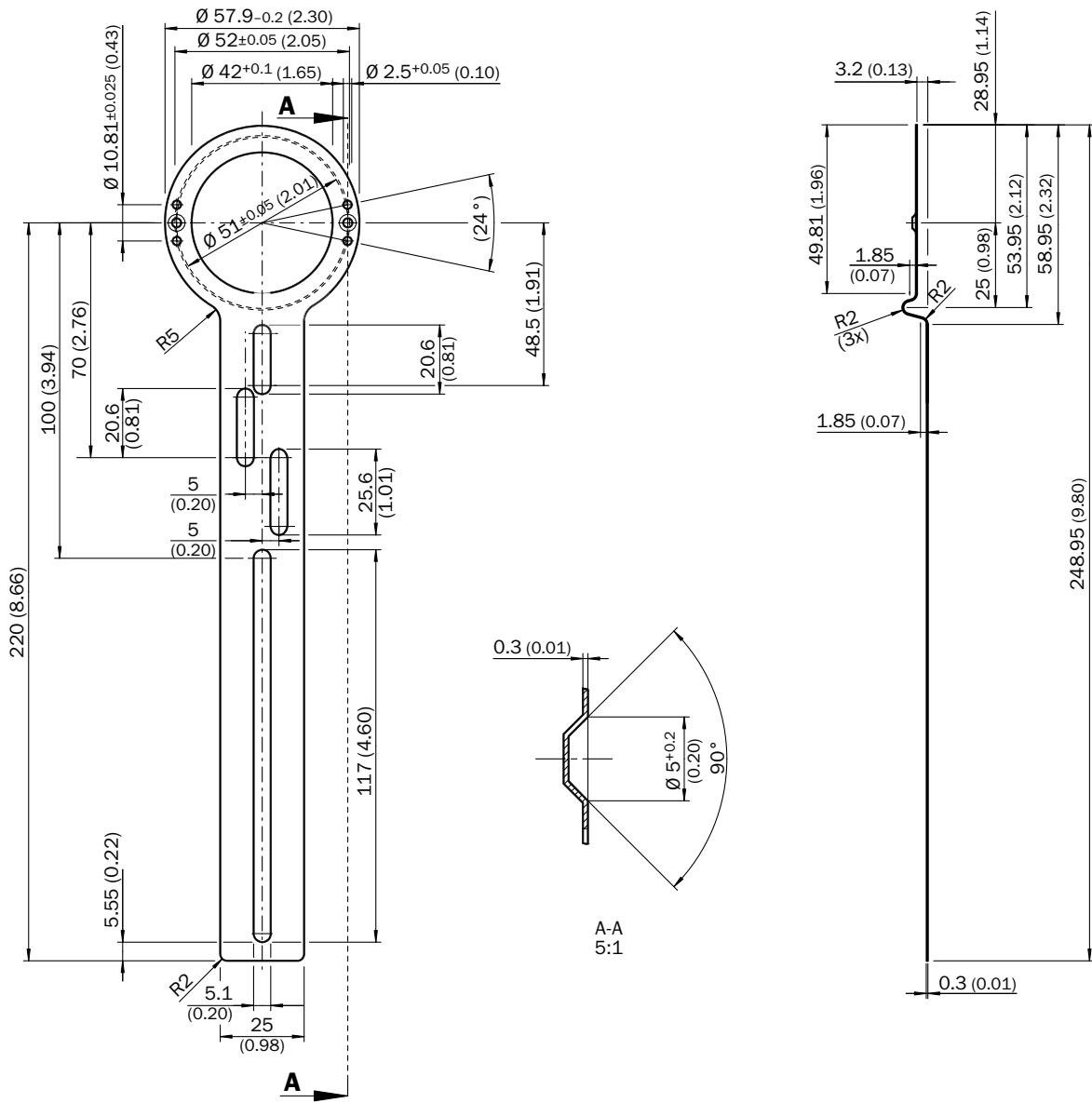
Mechanical adapters

Adaptor flange

| Adaptations	Model name	Part no.
Flange adapter, adapts face mount flange with 36 mm centering collar to 50 mm servo flange	BEF-FA-036-050	2029160
Flange adapter, adapts face mount flange with 36 mm centering collar to 60 mm square mounting plate	BEF-FA-036-060REC	2029162
Flange adapter, adapts face mount flange with 36 mm centering collar to 58 mm square mounting plate with shock absorber	BEF-FA-036-060RSA	2029163
Flange adapter, adapts face mount flange with 36 mm centering collar to 63 mm square mounting plate	BEF-FA-036-063REC	2034225

BEF-FA-036-050
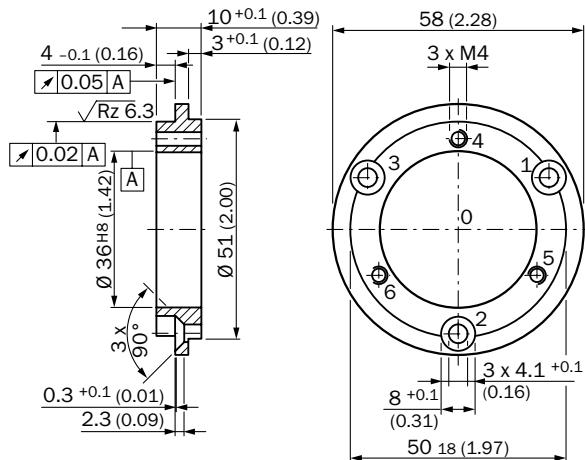
BEF-FA-036-060REC
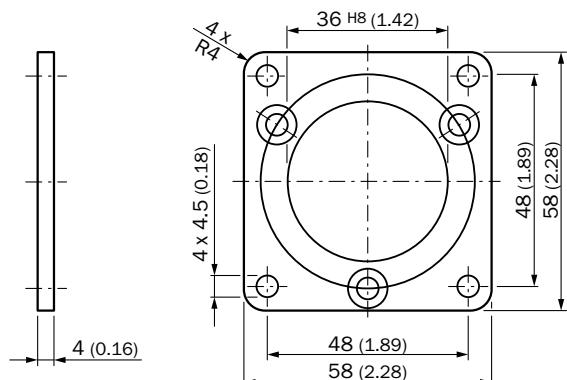
BEF-FA-036-060RSA
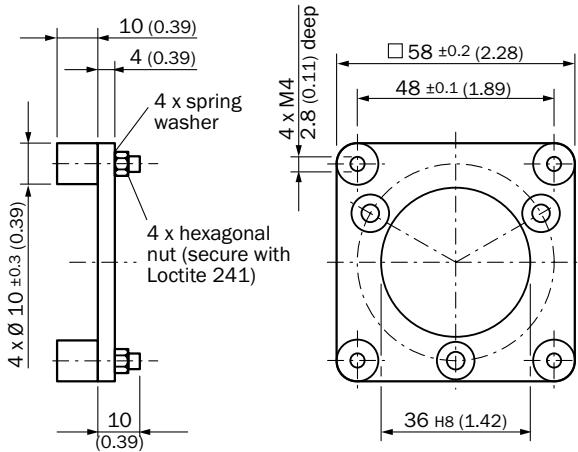
BEF-FA-036-063REC
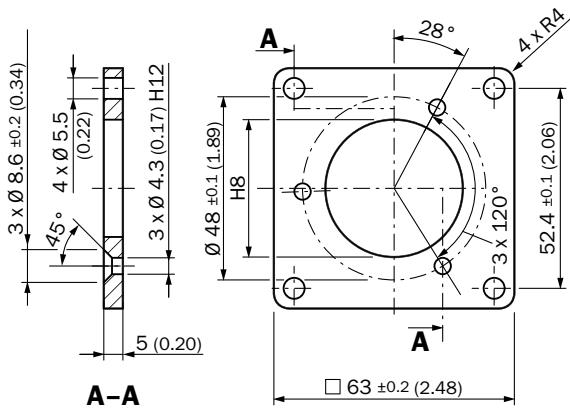
Mounting bells

Description	Model name	Part no.
Mounting bell for servo flange encoder with 50 mm centering collar incl. mounting kit	BEF-MG-50	5312987

BEF-MG-50
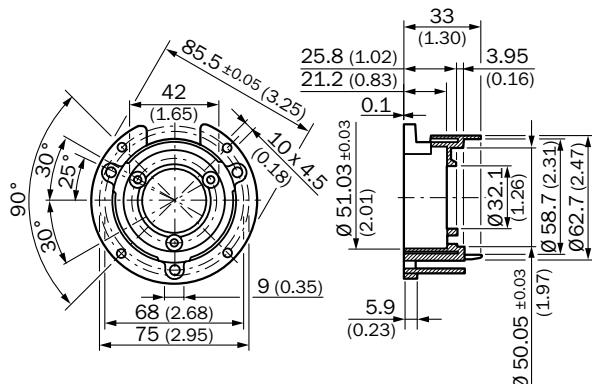
Mounting bracket

• Mounting bracket incl. mounting kit for encoder with face mount flange

Description	Model name	Part no.
Mounting bracket for encoder with 36 mm centering collar	BEF-WF-36	2029164

BEF-WF-36
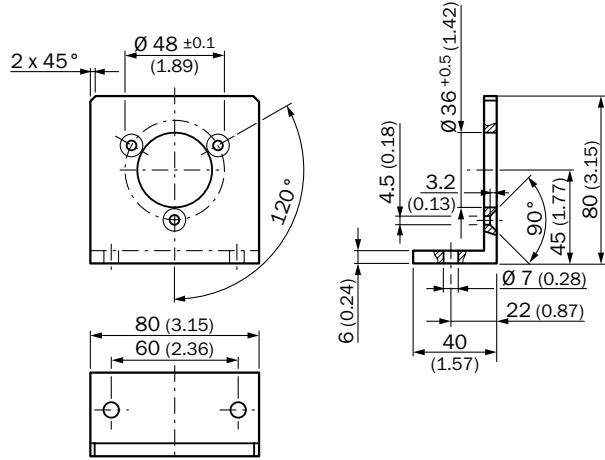
Servo clamps

| Description	Model name	Part no.
Servo clamp half-shells (set of 2) for 50 mm centering collar	BEF-WG-SF050	2029165
Servo clamps (set of 3), large	BEF-WK-SF	2029166

BEF-WG-SF050
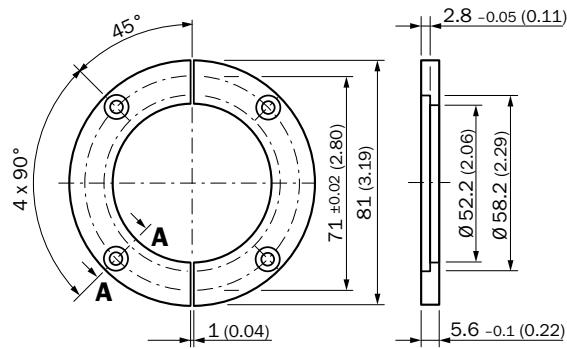
BEF-WK-SF
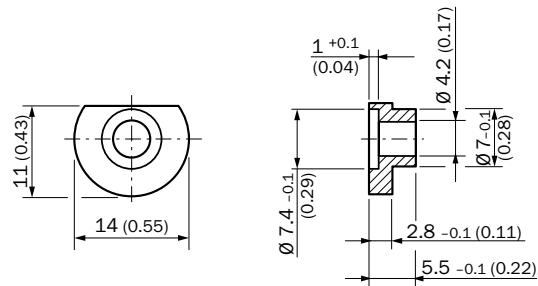
Bearing block

| Description	Model name	Part no.
Bearing block for hollow shaft encoder	BEF-FA-B12-010	2042728
Bearing block for servo and face mount flange encoder	BEF-FA-LB1210	2044591

BEF-FA-B12-010
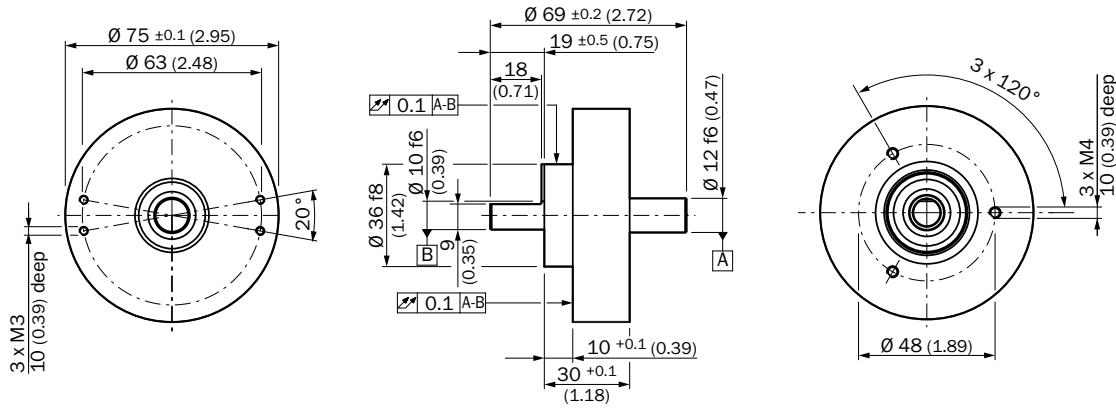
BEF-FA-LB1210
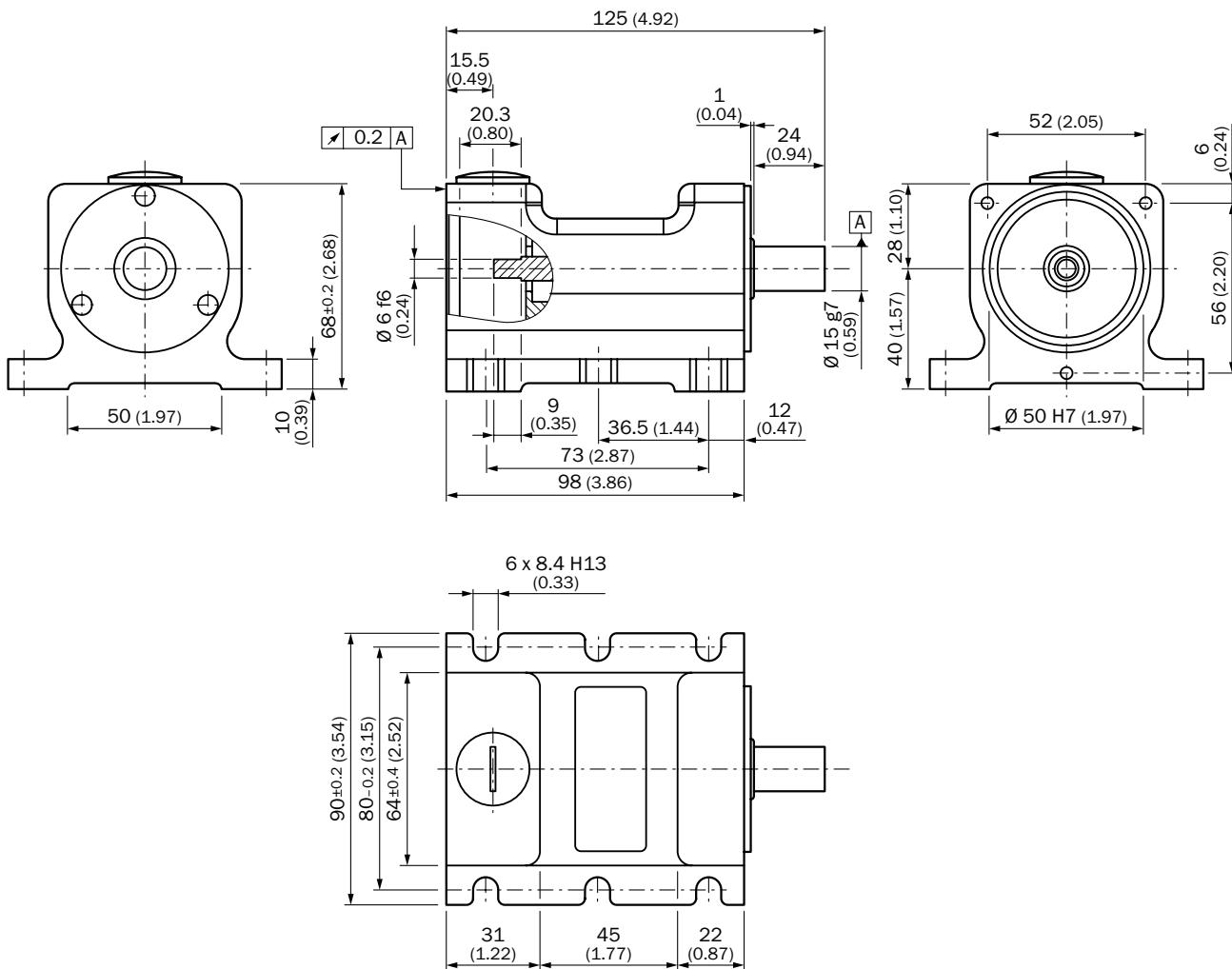
Measuring wheels

| Description	Model name	Part no.
Measuring wheel with smooth plastic surface (Hytrel) for 10 mm solid shaft, circumference 200 mm	BEF-MR-010020	5312988
Measuring wheel with ridged plastic surface (Hytrel) for 10 mm solid shaft, circumference 200 mm	BEF-MR-010020G	5318678

BEF-MR-010020
BEF-MR-010020G
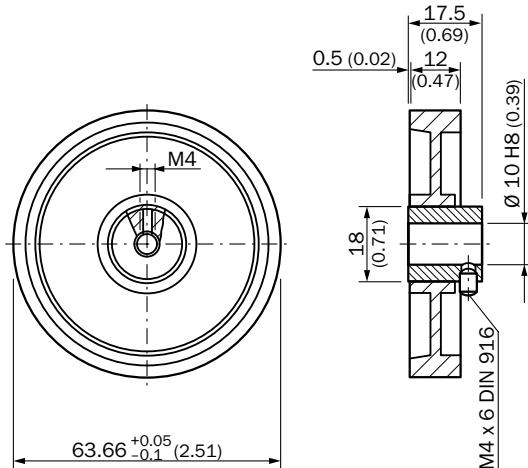
BEF-MR-010020 / BEF-MR-010020G dimensional drawing
17.5 (0.69) · 0.5 (0.02) · 12 (0.47) · Ø 10 H8 (0.39) · M4 · 18 (0.71) · M4 x 6 DIN 916 · 63.66 +0.05 −0.1 (2.51)

| Description	Model name	Part no.
Measuring wheel with smooth plastic surface (Hytrel) for 10 mm solid shaft, circumference 500 mm	BEF-MR-010050	5312989

BEF-MR-010050
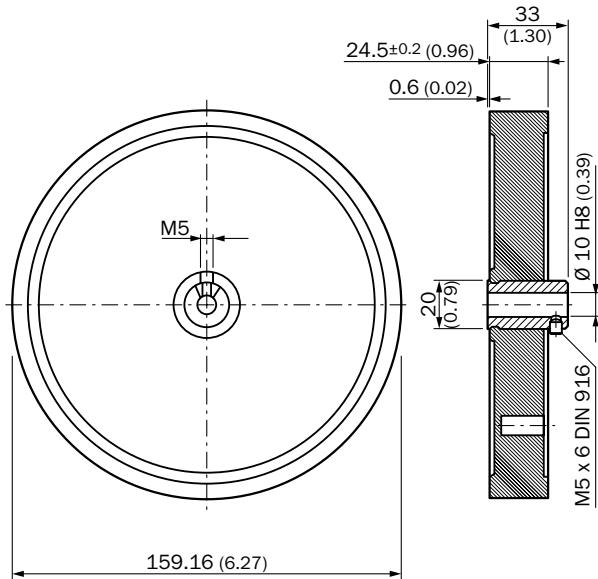
BEF-MR-010050 dimensional drawing
33 (1.30) · 24.5 ±0.2 (0.96) · 0.6 (0.02) · Ø 10 H8 (0.39) · M5 · 20 (0.79) · M5 x 6 DIN 916 · 159.16 (6.27)

Description	Model name	Part no.
Measuring wheel with O-ring surface (NBR70) for 6 mm solid shaft, circumference 200 mm	BEF-MR006020R	2055222
Measuring wheel with O-ring surface (NBR70) for 10 mm solid shaft, circumference 200 mm	BEF-MR010020R	2055224
Replacement O-ring set (set of 2) for measuring wheels (circumference 200 mm) with O-ring	BEF-OR-053-040	2064061

**BEF-MR006020R**
BEF-MR010020R
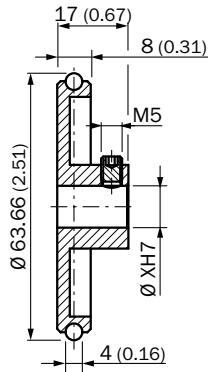
Description	Model name	Part no.
Measuring wheel with O-ring surface (NBR70) for 6 mm solid shaft, circumference 300 mm	BEF-MR006030R	2055634
Measuring wheel with O-ring surface (NBR70) for 10 mm solid shaft, circumference 300 mm	BEF-MR010030R	2049278
Replacement O-ring set (set of 2) for measuring wheels (circumference 300 mm) with O-ring	BEF-OR-083-050	2064076

**BEF-MR006030R**
BEF-MR010030R
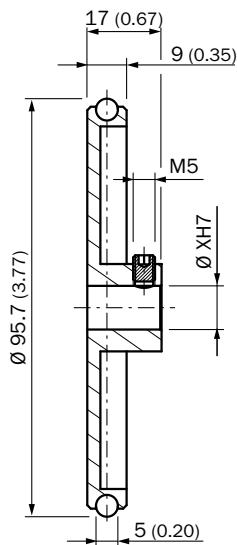
Description	Model name	Part no.
Measuring wheel with O-ring surface (NBR70) for 10 mm solid shaft, circumference 500 mm	BEF-MR010050R	2055227
Replacement O-ring set (set of 2) for measuring wheels (circumference 500 mm) with O-ring	BEF-OR-145-050	2064074

BEF-MR008050R
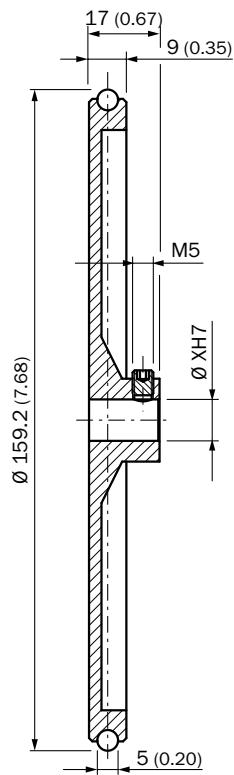
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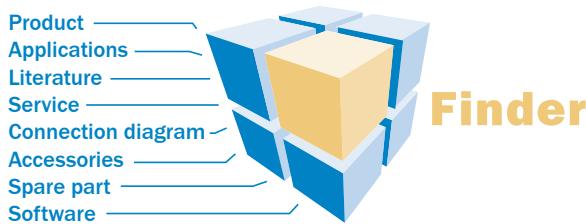
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SICK at a glance
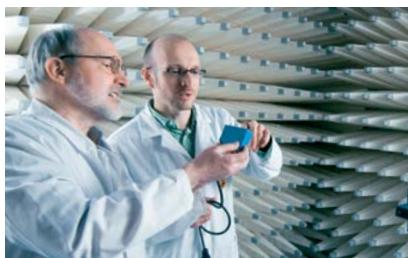
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