# DFS60
Incremental Encoders

High-resolution, programmable encoder for complex
applications and high operational demands

SICK

Sensor Intelligence.

High-resolution, programmable encoder for complex applications and high operational demands

Product description

The DFS60 is a high-resolution incremental encoder in a 60 mm design. The multitude of mechanical and electrical interfaces always allows for the design suitable for the application. Extensive programming options for customer-specific adjustments of the electrical interfaces and the number of lines from 1 to 65536.

Programming of the output signal and the zero pulse are unique in the market. The high enclosure rating, the large temperature range and the large ball bearing distance provide its great robustness, making the DFS60 an ideal encoder for all industrial applications featuring harsh ambient conditions.

At a glance

- Compact Ø 60 mm design
- High-resolution incremental encoder family up to 16 bit
- Programming of output voltage level by customer, zero pulse position, zero pulse width and number of lines from 1 ... 65536
- Programming using programming tool or machine controller (RS485)
- Plug-in cable output, radial or axial use

- M23 and M12 connector designs, available axial and radial
- Designs with face mount or servo flange, blind or through hollow shaft
- Hollow shaft designs up to Ø 15 mm oder 3/8". Insulated design available for through hollow shaft.
- Remote zero-set possible

Your benefit

- Reduced storage costs and down-times through programming by customer
- Customer-specific solutions with various cable lengths and connectors on cable end thanks to plug-in cable outlet in radial or axial direction
- Excellent concentricity even at high speeds
- Application implementable with high resolution

- Permanent and safe operation through high enclosure rating, temperature resistance and bearing lifetime
- The programmability using the PGT-08 programming software and the PGT-10-S display programming tool allow for a flexible and fast adaptation of the encoder to customer needs.
- Programmable zero pulse position simplifies installation

Additional information

Detailed technical specifications

Performance

Type	E	B	A
Number of lines per revolution [1] [2]	100 ... 2048 [2]	1 ... 10000 [2]	1 ... 65536 [2]
Measuring step	90° electrical / number of lines		
Reference signal			
Number	1		
Position	90° electr., logic operation with A and B		
Error limits	± 0.3°	± 0.05°	± 0.03°
Measuring step deviation			
Number of lines 1 ... 99	–	± 0.08°	± 0.04°
Number of lines 100 ... 10000	± 0.2°	± 0.01°	± 0.008°
Number of lines > 10000	–	–	± 0.002°

[1] See maximum revolution range on page 6.

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

Interfaces

Electrical interfaces	4.5 ... 5.5 V, TTL/RS422		
	10 ... 32 V, TTL/RS422		
	10 ... 32 V, HTL/push pull		
	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/HTL programmable with 0-set function on the M23 connector [1]	
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 ... 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 zero pulse teach [2]	–	H – active; (L = 0 ... 3 V, H = 4 ... U_s V)	

[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.

Mechanics/Electrical system

Type	E	B	A
Shaft diameter			
Face mount flange	10 x 19 mm		
Servo flange	6 x 10 mm		
Blind hollow shaft, metal through hollow shaft	6, 8, 10, 12, 14, 15 mm and 3/8", 1/2", 5/8"		
Plastic through hollow shaft	10, 12, 14, 15 mm and 3/8", 1/2"		
Ground			
Face mount flange, servo flange	0.3 kg		
Blind hollow shaft, through hollow shaft	0.2 kg		
Rotor moment of inertia			
Face mount flange, servo flange	6.2 gcm^2		
Blind hollow shaft, through hollow shaft	40 gcm^2		
Max. output frequency			
TTL/RS422	300 kHz	600 kHz	820 kHz
HTL/Push pull	300 kHz	600 kHz	820 kHz
TTL/HTL programmable	–	600 kHz	820 kHz
Operating speed [1]			
Face mount flange, servo flange	10,000 rpm		
Blind hollow shaft	6,000 rpm		
Plastic through hollow shaft	9,000 rpm	12,000 rpm	
Metal through hollow shaft	9,000 rpm		
Angular acceleration	5 x 10^5 rad/s^2		
Operating torque at 20 °C			
Face mount flange, servo flange	0.3 Ncm		
Blind hollow shaft, through hollow shaft	0.6 Ncm		
Start-up torque at 20 °C			
Face mount flange, servo flange	0.5 Ncm		
Blind hollow shaft, through hollow shaft	0.8 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/± 0.01 mm (axial)
Bearing lifetime	3.6 x 10^{10} revolutions		
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 programmable	–	30 mA	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	30 mA	
Operating current with no load			

Type	E	B	A
4.5 ... 5.5 V, TTL/RS422	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 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 ... 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 [2]		
10 ... 32 V, TTL/RS422	Yes [3]		
10 ... 32 V, HTL/push pull	Yes [2]		
4.5 ... 5.5 V, TTL/RS422, 0-SET	Yes [2]		
10 ... 32 V, TTL/RS422, 0-SET	Yes [3]		
10 ... 32 V, HTL/Push pull, 0-SET	Yes [2]		
4.5 ... 32 V, TTL/HTL programmable	–	Yes, HTL [2] and TTL [3]	
4.5 ... 32 V, TTL/HTL programmable, 0-SET	–	Yes, HTL [2] and TTL [3]	

[1] Internal heating 3.3 k/1,000 rpm, note when designing working temperature range.

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

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

Ambient data

Working temperature range	0 ... +85 °C	–30 ... +100 °C	
Storage temperature range (without packaging)	–40 ... +100 °C		
Permissible relative air humidity [1]	90 %		
EMC [2]	As per EN 61000-6-2 and EN 61000-6-3		
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
Enclosure rating as per IEC 60529			
On the shaft	IP 65		
On the housing, connector outlet [3]	IP 67		
On the housing, cable outlet	IP 67		

[1] Condensation on the optical scanner not permissible.

[2] 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.

[3] 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
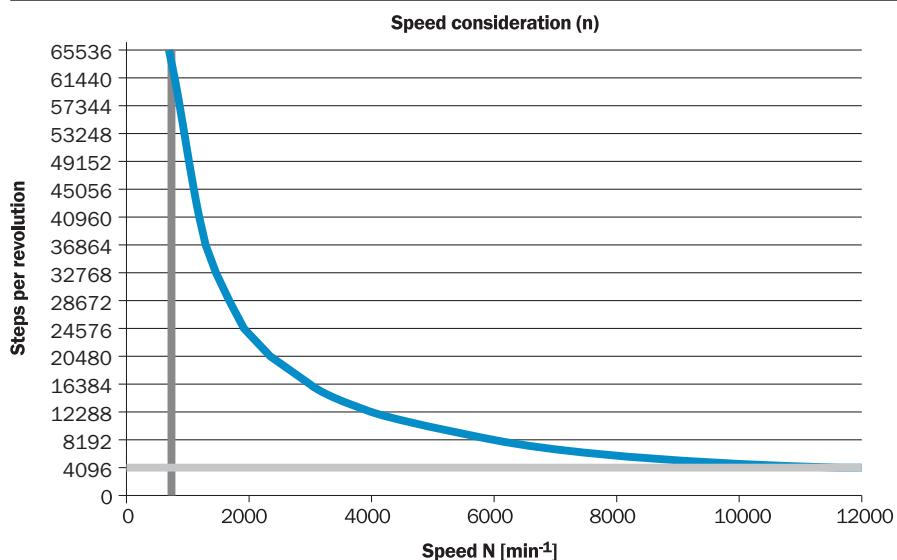
Ordering information

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

Type

B Number of lines per revolution programmable 1 ... 10000

A Number of lines 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

C M12 connector, 8-pin, radial

D M12 connector, 8-pin, axial

K 8-core cable, universal 1.5 m [7)]

L 8-core cable, universal 3 m [7)]

M 8-core cable, universal 5 m [7)]

Number of lines
(factory set number of lines per revolution with type B: 10000, with type A: 65536)

Always 5 digits in text, see "Number of lines per revolution" on page 13

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

[7)] 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:

• Number of lines per revolution from 1 ... 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
• Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
• Zero pulse width mechanically 1° ... 359° using programming tool PGT-10-S (see accessories on page 23).
• Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
• Zero SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 23) and with devices with M23 connector outlet via PIN 7 (connection type A and B).

Ordering code for blind hollow shaft, **programmable**

Type

B	Number of lines per revolution programmable 1 … 10000
A	Number of lines 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
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial
K	8-core cable, universal 1.5 m [7]
L	8-core cable, universal 3 m [7]
M	8-core cable, universal 5 m [7]

Number of lines
(factory set number of lines per revolution with type B: 10000, with type A: 65536)

Always 5 digits in text, see "Number of lines per revolution" on page 13

D	F	S	6	0		–	B								

[7] 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:

- Number of lines per revolution from 1 … 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
- Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
- Zero pulse width mechanically 1° … 359° using programming tool PGT-10-S (see accessories on page 23).
- Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
- Zero SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 23) and with devices with M23 connector outlet via PIN 7 (connection type A and B).

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

Type

| B | Number of lines per revolution programmable 1 … 10000 |
| A | Number of lines 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"
3	Plastic through hollow shaft, 3/8"
4	Plastic through hollow shaft, 10 mm
5	Plastic through hollow shaft, 12 mm
6	Plastic through hollow shaft, 1/2"
7	Plastic through hollow shaft, 14 mm
8	Plastic through hollow shaft, 15 mm

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 [7]
L	8-core cable, universal 3 m [7]
M	8-core cable, universal 5 m [7]

Number of lines
(factory set number of lines per revolution with type B: 10000, with type A: 65536)

Always 5 digits in text, see "Number of lines per revolution" on page 13

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

[7] 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:

- Number of lines per revolution from 1 … 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
- Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
- Zero pulse width mechanically 1° … 359° using programming tool PGT-10-S (see accessories on page 23).
- Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 23).
- Zero SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 23) and with devices with M23 connector outlet via PIN 7 (connection type A and B).

Ordering code for face mount flange and servo flange (highlighted in blue – standard types), **not programmable**

Type

E	Number of lines per revolution 100 ... 2048
B	Number of lines per revolution 1 ... 10000
A	Number of lines 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
U	4.5 ... 5.5 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)
V	10 ... 32 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)
W	10 ... 32 V, HTL/push pull, 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
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial
K	8-core cable, universal 1.5 m [7]
L	8-core cable, universal 3 m [7]
M	8-core cable, universal 5 m [7]

Number of lines

Always 5 digits in text, see "Number of lines per revolution" on page 13

D	F	S	6	0		–	S								

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

Ordering code for blind hollow shaft (highlighted in blue – standard types), **not programmable**

Type

E	Number of lines per revolution 100 … 2048
B	Number of lines per revolution 1 … 10000
A	Number of lines 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
U	4.5 … 5.5 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)
V	10 … 32 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)
W	10 … 32 V, HTL/push pull, 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
C	M12 connector, 8-pin, radial
D	M12 connector, 8-pin, axial
K	8-core cable, universal 1.5 m [7]
L	8-core cable, universal 3 m [7]
M	8-core cable, universal 5 m [7]

Number of lines

Always 5 digits in text, see "Number of lines per revolution" on page 13

D	F	S	6	0		–	B								

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

Ordering code for through hollow shaft (highlighted in blue - standard types), **not programmable**

Type

E	Number of lines per revolution 100 ... 2048
B	Number of lines per revolution 1 ... 10000
A	Number of lines 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"
3	Plastic through hollow shaft, 3/8"
4	Plastic through hollow shaft, 10 mm
5	Plastic through hollow shaft, 12 mm
6	Plastic through hollow shaft, 1/2"
7	Plastic through hollow shaft, 14 mm
8	Plastic through hollow shaft, 15 mm

Electrical interface

A	4.5 ... 5.5 V, TTL/RS422
C	10 ... 32 V, TTL/RS422
E	10 ... 32 V, HTL/push pull
U	4.5 ... 5.5 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)
V	10 ... 32 V, TTL/RS422, with 0-set function on pin 7 of the M23 connector. (Only in connection with connection type A or B)
W	10 ... 32 V, HTL/push pull, 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 [7]
L	8-core cable, universal 3 m [7]
M	8-core cable, universal 5 m [7]

Number of lines

Always 5 digits in text, see "Number of lines per revolution" on page 13

D	F	S	6	0		–	T									

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

Number of lines per revolution

Number of lines per revolution	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

Dimensional drawings

Face mount flange, cable outlet
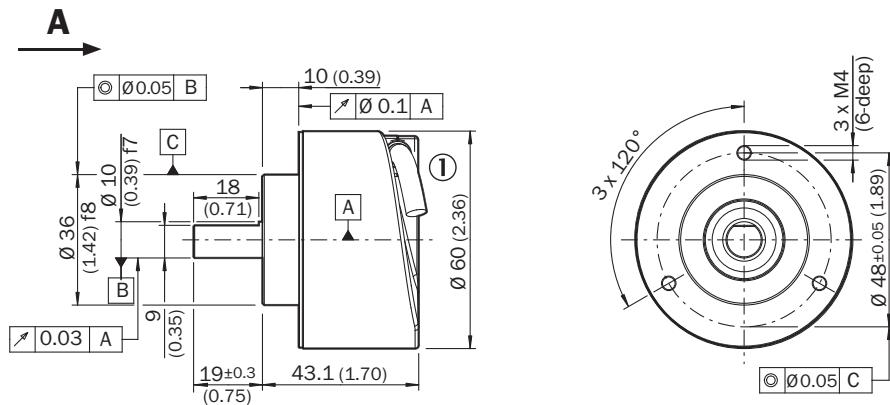
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

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

Face mount flange, radial connector outlet M12 and M23
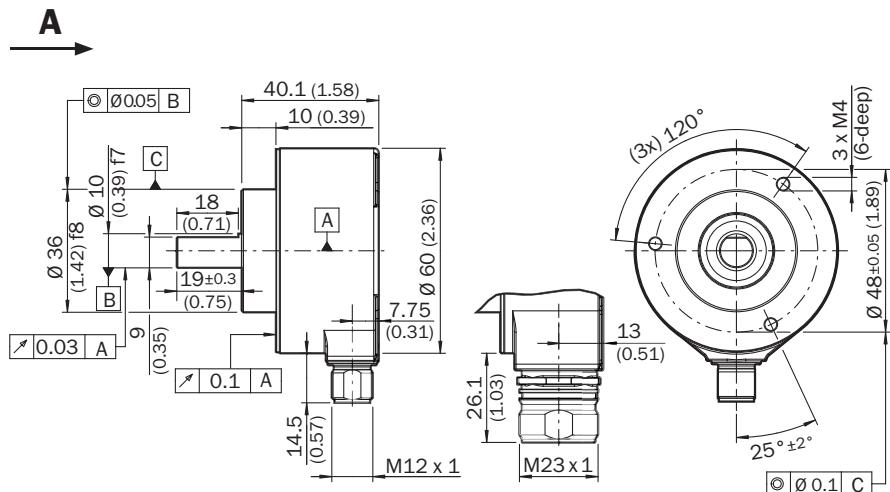
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

Face mount flange, axial connector outlet M12 and M23

Connector orientation

X1   X2

X2
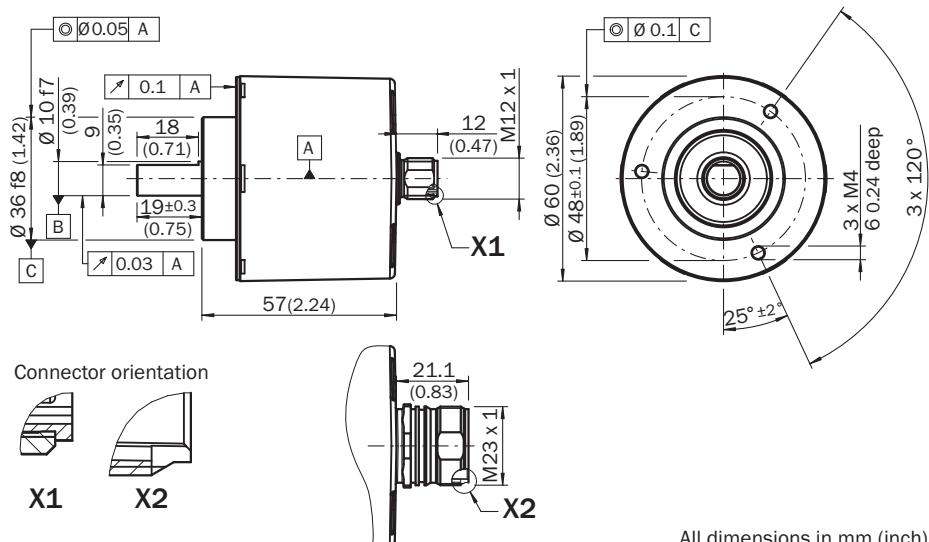
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

Servo flange, cable outlet
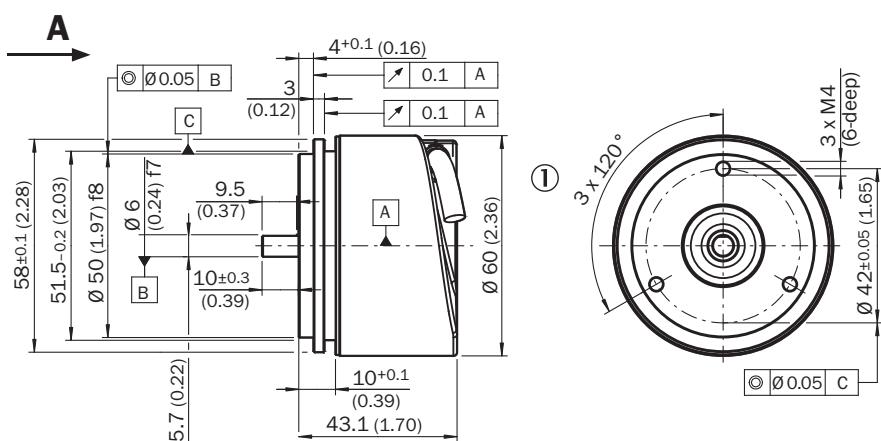
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

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

Servo flange, radial connector outlet M12 and M23

All dimensions in mm (inch)
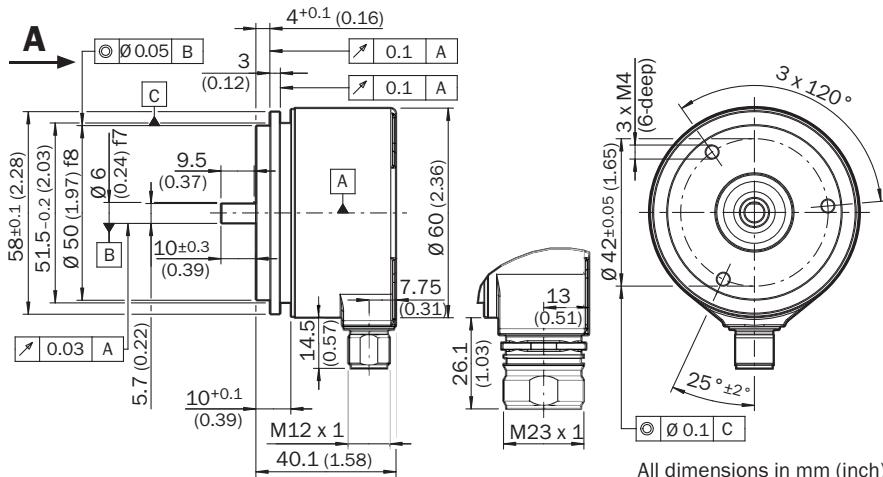
General tolerances as per DIN ISO 2768-mk.

Servo flange, axial connector outlet M12 and M23

Connector orientation

X1   X2

All dimensions in mm (inch)
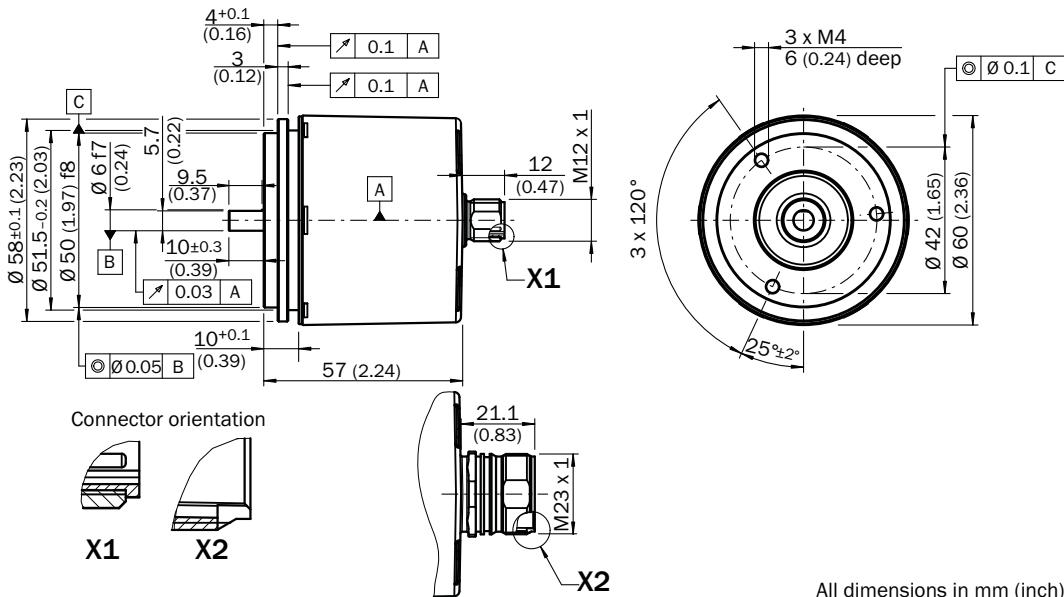
General tolerances as per DIN ISO 2768-mk.

Mounting suggestion for small servo clamp part no. 2029166

Ø 68 (2.68)

All dimensions in mm (inch)
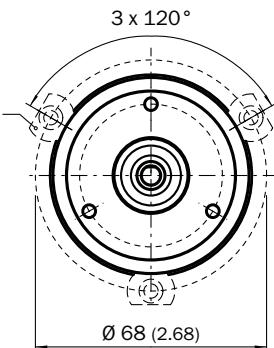
Mounting suggestion for half-shell servo clamp part no. 2029165

Ø 71 (2.80)

All dimensions in mm (inch)
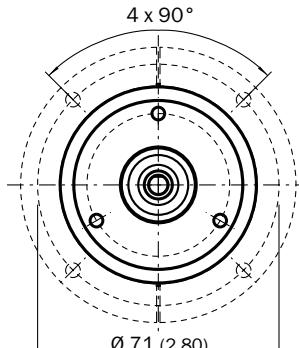
Blind hollow shaft, cable outlet

A

45.5 (1.79)
9.4 (0.37)
3.4 (0.13)
47 (1.85)
Ø X F7
①
Ø 35 (1.38)
Ø 60 (2.36)
2.5 (0.10)

Ø 3.2⁺⁰·¹ (0.13)
20°
Ø 63±0.2 (2.48)
72±0.3 (2.83)
20 (0.79)

min. 15 (0.59)
max. 42 (1.65)

All dimensions in mm (inch)
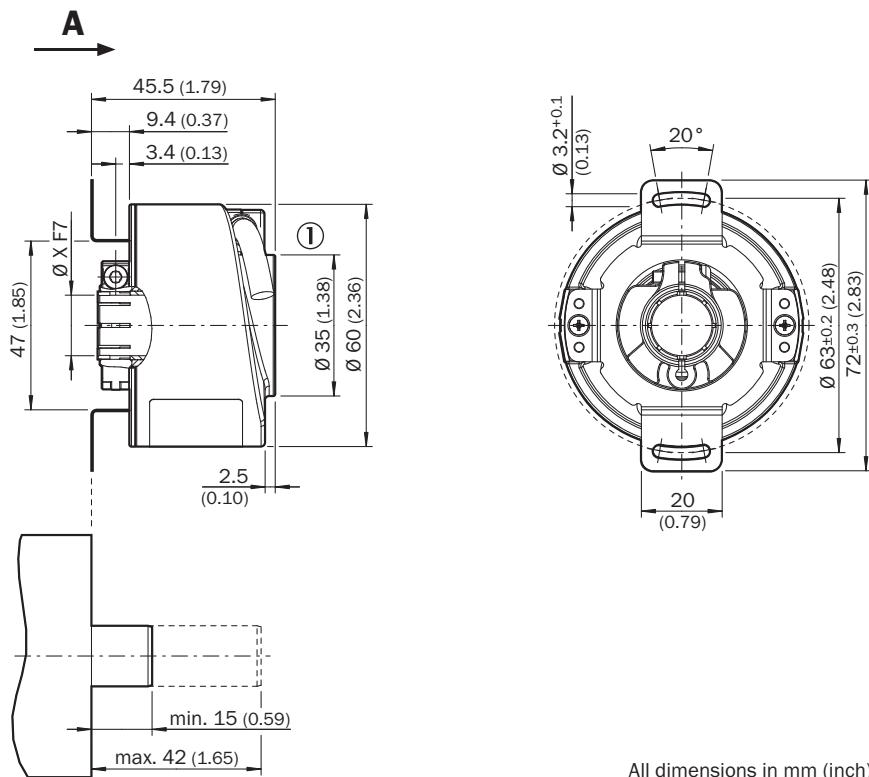
General tolerances as per DIN ISO 2768-mk.

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

Blind hollow shaft, radial connector outlet M12 and M23

A

45.5 (1.79)
9.4 (0.37)
3.4 (0.13)
2.5 (0.10)
Ø X F7
Ø 32.6 (1.28)
Ø 60 (2.36)
7.75 (0.31)
14.5 (0.57)
26.1 (1.03)
13 (0.51)
M12 x 1
M23 x 1

72±0.3 (2.83)
Ø 3.2⁺⁰·¹ (0.13)
20 (0.79)
20°
47 (1.85)
Ø 63±0.2 (2.48)

min. 15 (0.59)
max. 42 (1.65)

All dimensions in mm (inch)
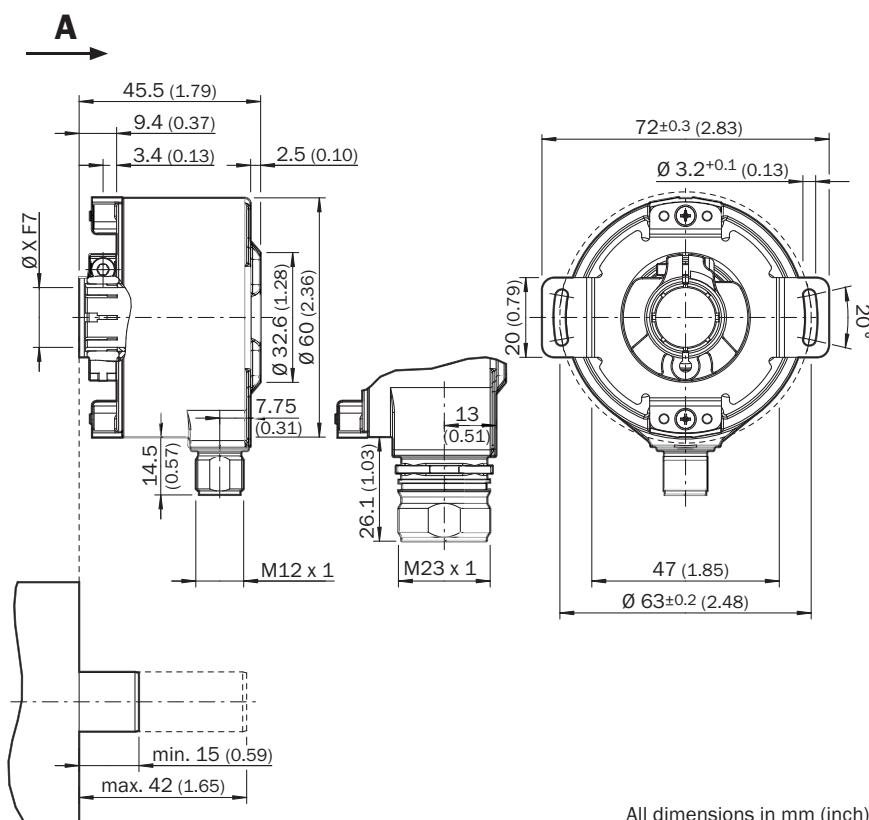
General tolerances as per DIN ISO 2768-mk.

Blind hollow shaft, axial connector outlet M12 and M23
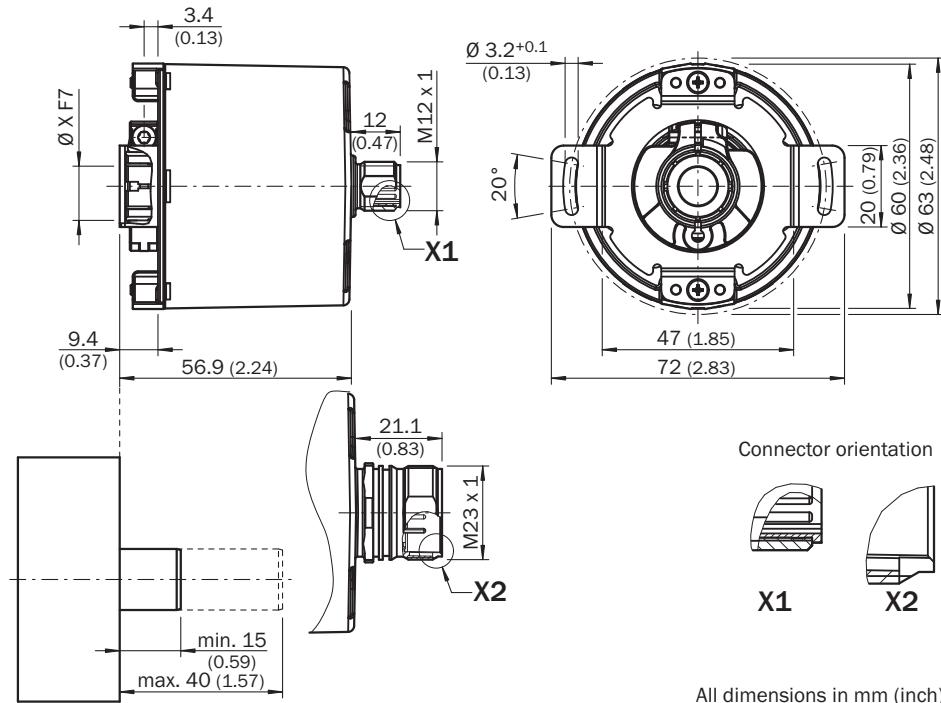
Connector orientation

X1   X2

All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

Through hollow shaft plastic, cable outlet
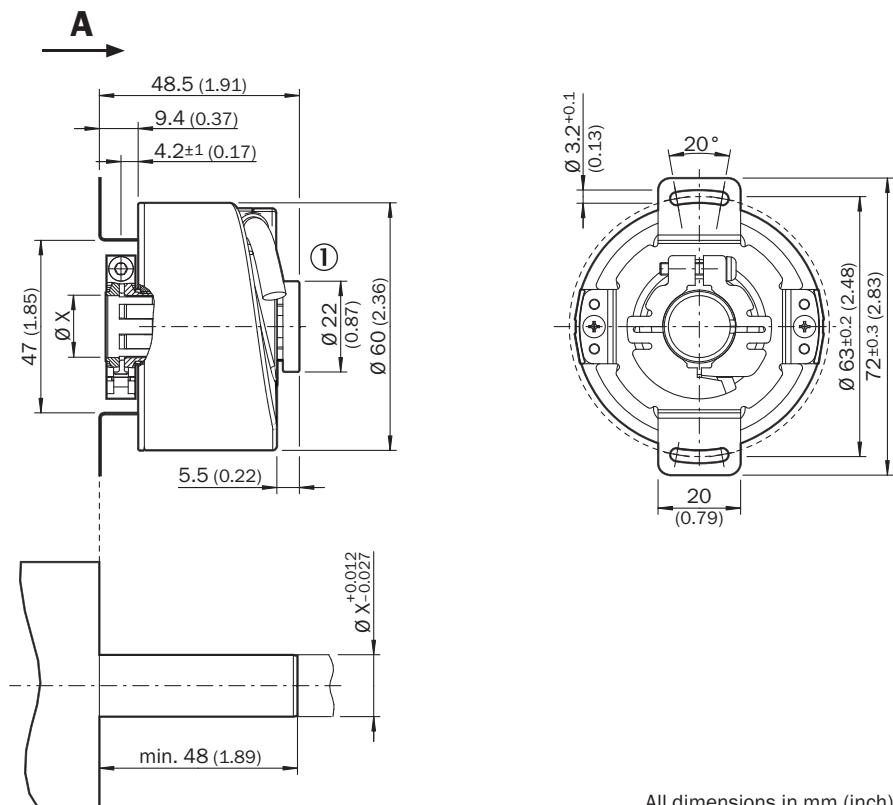
A

All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

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

Through hollow shaft plastic, radial connector outlet M12 and M23
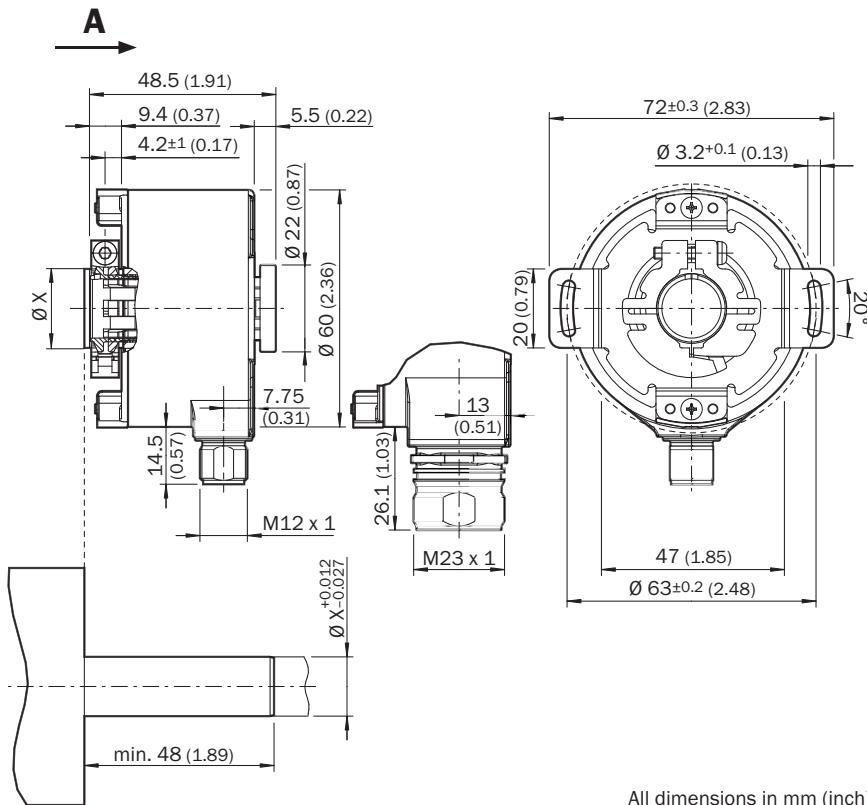
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

Through hollow shaft metal, cable outlet
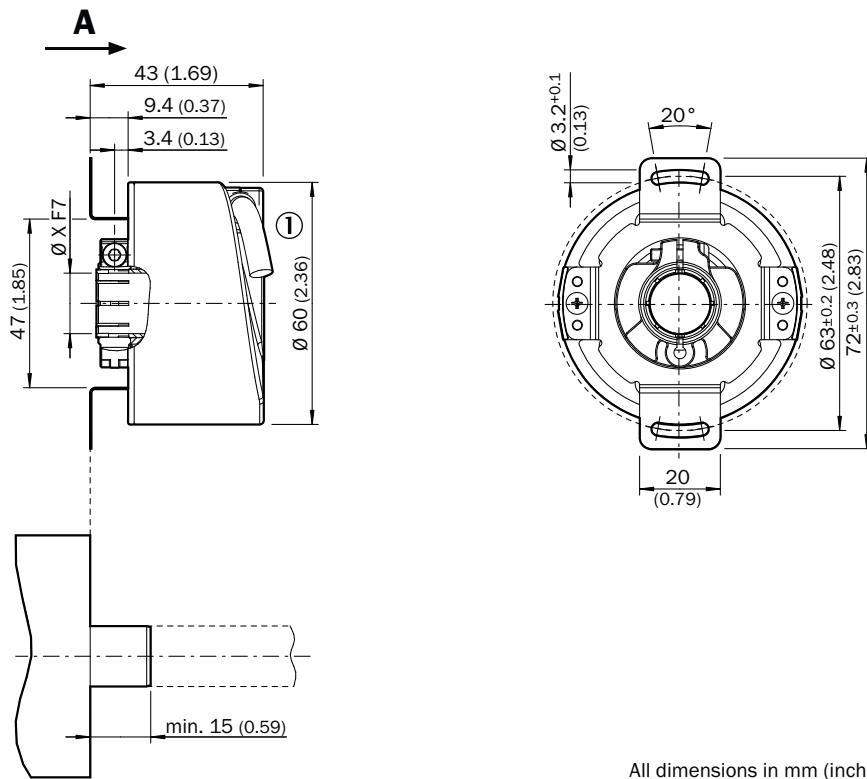
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk.

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

Through hollow shaft metal, radial connector outlet M12 and M23

A

43 (1.69)
9.4 (0.37)
3.4 (0.13)

Ø X F7

Ø 60 (2.36)

7.75 (0.31)

14.5 (0.57)

M12 x 1

26.1 (1.03)

13 (0.51)

M23 x 1

72±0.3 (2.83)

Ø 3.2+0.1 (0.13)

20 (0.79)

20°

47 (1.85)

Ø 63±0.2 (2.48)

min. 15 (0.59)

All dimensions in mm (inch)
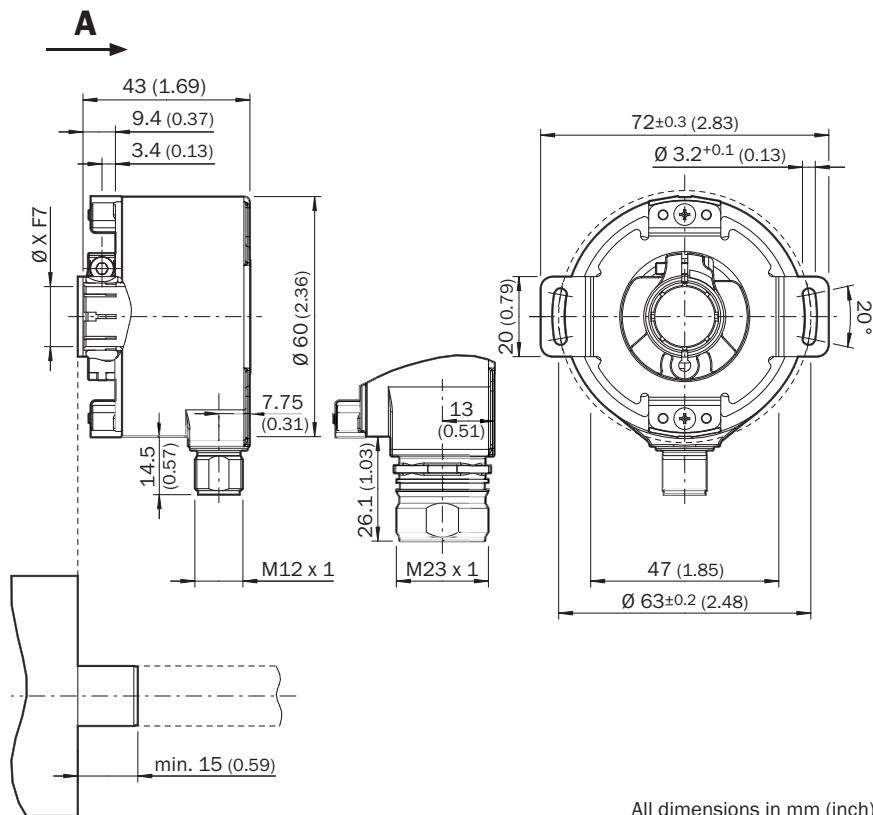
General tolerances as per DIN ISO 2768-mk.

PIN and core assignment

8-core cable

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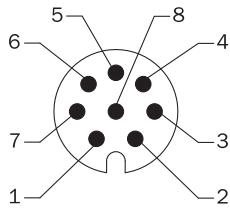
View of M23 device connector on encoder
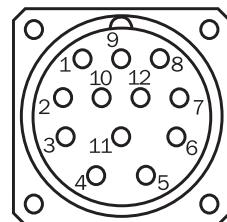
PIN, 8-pin, M12 connector	PIN, 12-pin, M23 connector	Core colors of encoders with cable outlet	TTL/HTL signal	Explanation
1	6	Brown	$\overline{A}$	Signal cable
2	5	White	A	Signal cable
3	1	Black	$\overline{B}$	Signal cable
4	8	Pink	B	Signal cable
5	4	Yellow	$\overline{Z}$	Signal cable
6	3	Lilac	Z	Signal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

[1] Only at 4.5 … 32 V, TTL/HTL programmable

The SET input serves to carry out the zero pulse teach function. If the 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".

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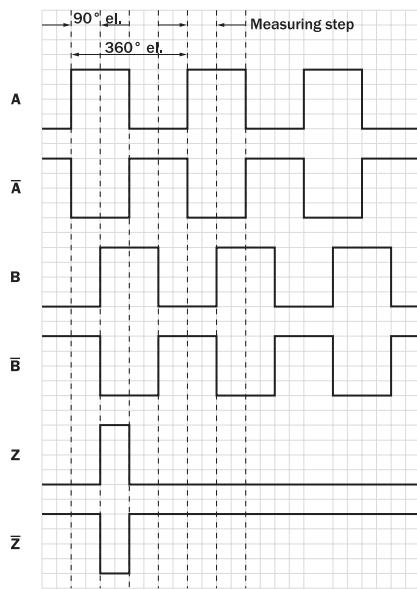
Cw looking towards the encoder shaft pointing towards "A" , see dimensional drawing.

Electrical zero pulse width 90°, 180° or 270° programmable
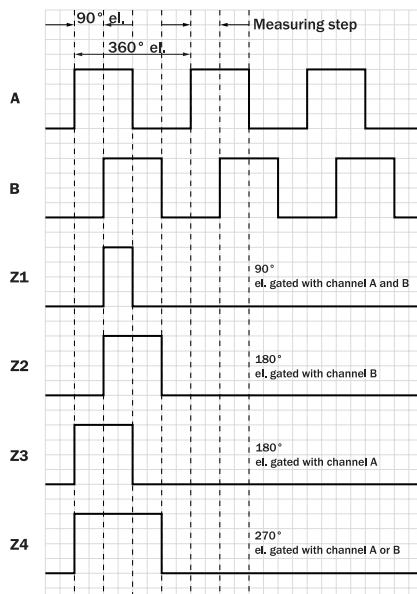
Cw looking towards the encoder shaft pointing towards "A" ,
see dimensional drawing.

Mechanical zero pulse width 1° to 359° programmable
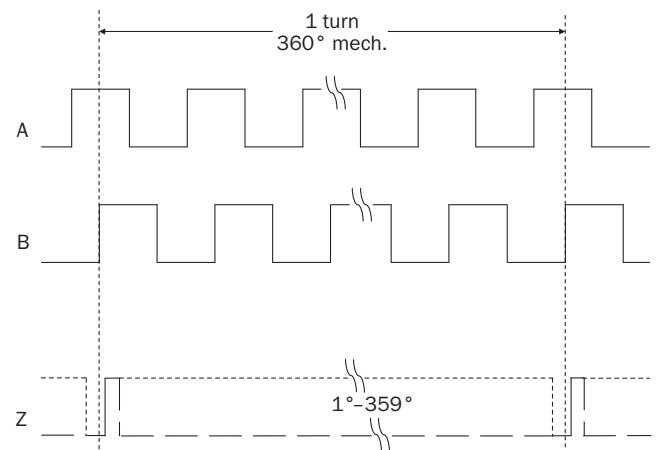
Accessories

Programming Tools

	Description	Type	Part no.
	Programming tool for DFS60 (connection to commercially available PCs or notebooks)	PGT-08-S	1036616
	Programming tool stand alone for DFS60	PGT-10-S	1052967

Adapter cable for programming tools

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

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

	Description	Type	Part no.
	Adapter cable for PGT-08-S and PGT-10-S incremental with SUB-D 9-pin cable connector and M12 8-pin cable socket, fitted with 8-core cable, 4 x 2 x 0.08 mm^2, shielded, cable length of 0.5 m	DSL-2D08-G0M5AC3	2046579
	Adapter cable for PGT-08-S and PGT-10-S incremental with SUB-D 9-pin cable connector and M23 12-pin cable socket, fitted with 8-core cable, 4 x 2 x 0.08 mm^2, shielded, cable length of 0.5 m	DSL-3D08-G0M5AC3	2046580
	PGT-10-S adapter cable with SUB-D 9-pin cable connector, shielded, cable length of 0.5 m for DFS60 with cable outlet	DSL-0D08-G0M5AC3	2061739

Plug connectors and cables

M12 screw-in system

• Straight, shielded, convertible (on adapter)

Contacts	Cable diameter	Description	Type	Part no.
8	4 ... 8 mm	Cable connector	STE-1208-GA01	6044892
		Cable socket	DOS-1208-GA01	6045001

STE-1208-GA01   **DOS-1208-GA01**

cable diameter
4 (.16) to 8 (.31)
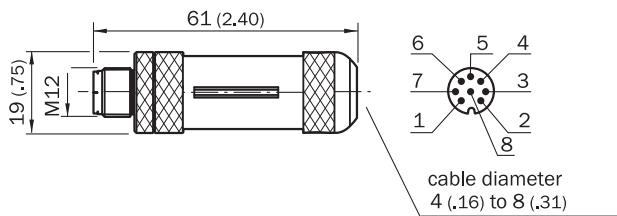
cable diameter
4 (.16) to 8 (.31)

All dimensions in mm (inch)
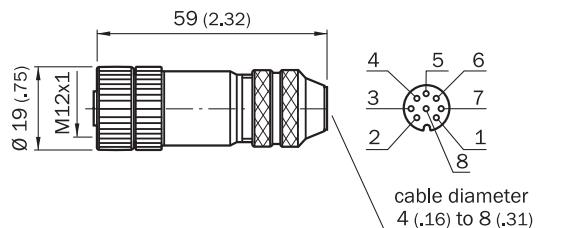
All dimensions in mm (inch)

Cables

• With shield

Cores	Cable diameter	Description	Cable length	Type	Part no.
8	5.6 mm	Cable of 4 x 2 x 0.15 mm², carrier-capable	Bulk goods	LTG-2308-MWENC	6027529
		Cable incl. gasket, 4 x 2 x 0.15 mm², for DFS60 with cable outlet	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	Cable of 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm²	Bulk goods	LTG-2411-MW	6027530
12	7.8 mm	Cable of 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm², carrier-capable	Bulk goods	LTG-2512-MW	6027531
		Cable of 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm², carrier-capable, UV- and salt water resistant	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

M23 screw-in system

- Straight, shielded

Contacts	Description	Type	Part no.
12	Cable connector	STE-2312-G	6027537
	Cable socket	DOS-2312-G	6027538

STE-2312-G
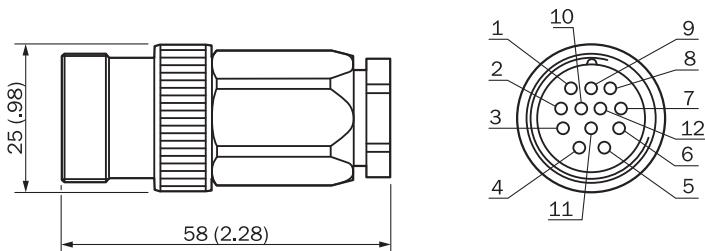
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk

DOS-2312-G
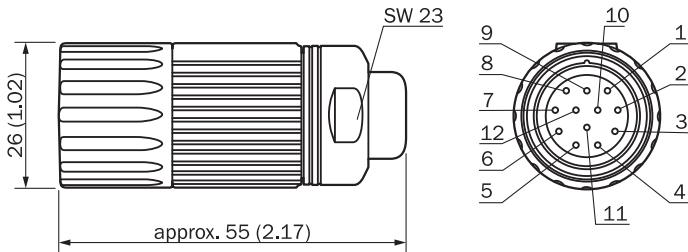
All dimensions in mm (inch)

General tolerances as per DIN ISO 2768-mk

Description	Cable length	Type	Part no.
Cable socket, 12-pin, straight, 11-core, cable, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm², shielded, cable diameter of 7.8 mm **Warning!** Only in combination with the electrical interfaces A, C, E and P	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

Description	Cable length	Type	Part no.
Cable socket, 12-pin, straight, 12-core, cable, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm², shielded, cable diameter of 7.8 mm **Warning!** Only in combination with the electrical interfaces A, C, E and P	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

Description	Cable length	Type	Part no.
Cable socket, 12-pin, straight, cable [1] 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm², shielded, cable diameter of 7.8 mm **Warning!** Only in combination with the electrical interfaces U, V, W and M	2.0 m	DOL-2312-G02MLA4	2062202
	7.0 m	DOL-2312-G07MLA4	2062203
	10.0 m	DOL-2312-G10MLA4	2062204
	15.0 m	DOL-2312-G15MLA4	2062205
	20.0 m	DOL-2312-G20MLA4	2062206
	25.0 m	DOL-2312-G25MLA4	2062207
	30.0 m	DOL-2312-G30MLA4	2062208

Description	Cable length	Type	Part no.
Cable socket, 12-pin, straight, cable [1] 12-core, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm², shielded, carrier-capable, cable diameter of 7.8 mm **Warning!** Only in combination with the electrical interfaces U, V, W and M	1.5 m	DOL-2312-G1M5MA4	2062240
	3.0 m	DOL-2312-G03MMA4	2062243
	5.0 m	DOL-2312-G05MMA4	2062244
	10.0 m	DOL-2312-G10MMA4	2062245
	20.0 m	DOL-2312-G20MMA4	2062246
	30.0 m	DOL-2312-G30MMA4	2062247

[1] Core assignment see page 21, yet additionally 0-SET function, core color orange.

M12 screw-in system

- Straight, shielded

Description	Cable length	Type	Part no.
Cable socket, 8-pin, straight, fitted with 8-core cable, 4 x 2 x 0.25 mm², shielded, carrier-capable (on adapter)	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
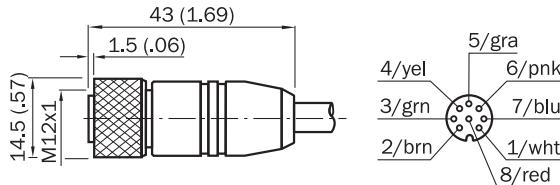
All dimensions in mm (inch)

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.

Shaft diameter	Type	Part no.
6 mm ... 6 mm	KUP-0606-B	5312981
6 mm ... 10 mm	KUP-0610-B	5312982
10 mm ... 10 mm	KUP-1010-B	5312983
10 mm ... 12 mm	KUP-1012-B	5312984

KUP-0606-B
KUP-0610-B
KUP-1010-B

Cheese-head screw
M2.5 x 8, DIN 912 A2

21±1 (0.83)   29±1 (1.14)
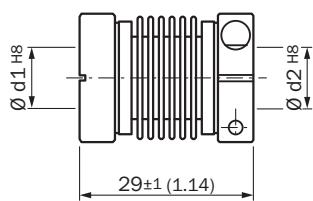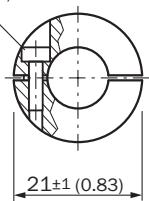
All dimensions in mm (inch)

KUP-1012-B

Cheese-head screw
M2.5 x 8, DIN 912 A2

24 (0.94)   29±1 (1.14)
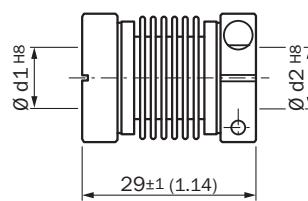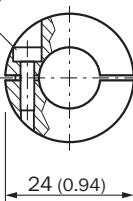
All dimensions in mm (inch)

- 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.

Shaft diameter	Type	Part no.
6 mm ... 10 mm	KUP-0610-F	5312985
10 mm ... 10 mm	KUP-1010-F	5312986

KUP-0610-F
KUP-1010-F

22 (0.87)
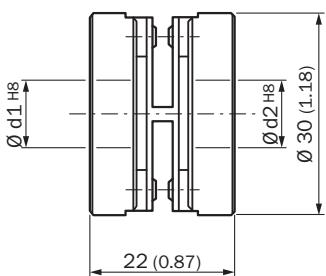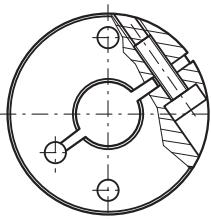
All dimensions in mm (inch)

Mechanical adapters

Adaptor flange

• Adaptor flange made of aluminum for face mount flanges, 36 mm spigot.

Adaptations	Type	Part no.
On 50 mm servo flange	BEF-FA-036-050	2029160
Onto square 60 mm installation plate	BEF-FA-036-060REC	2029162
Onto square 60 mm installation plate with shock absorber	BEF-FA-036-060RSA	2029163
Onto square 63 mm installation plate	BEF-FA-036-063REC	2034225

BEF-FA-036-050
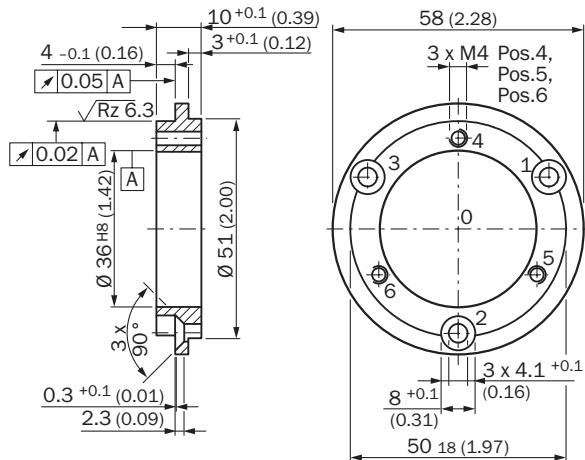
All dimensions in mm (inch)

BEF-FA-036-060REC
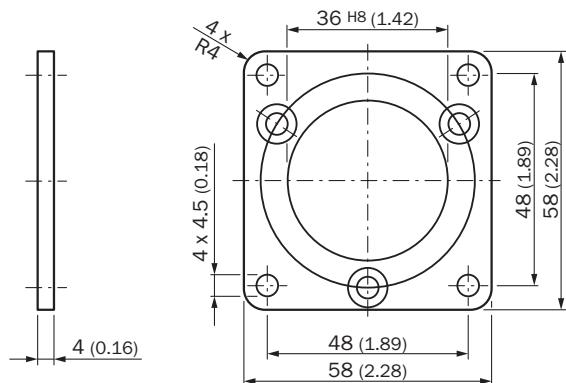
All dimensions in mm (inch)

BEF-FA-036-060RSA
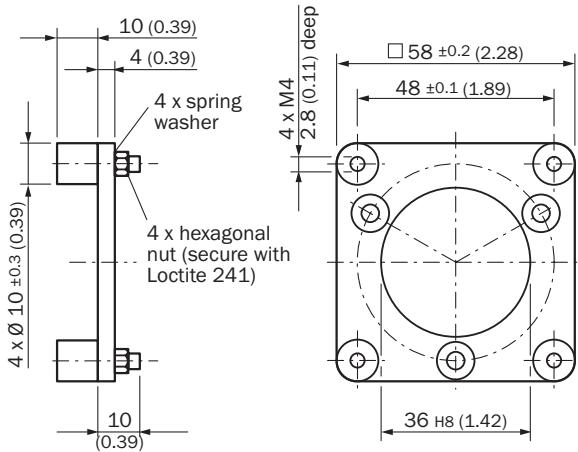
All dimensions in mm (inch)

BEF-FA-036-063REC
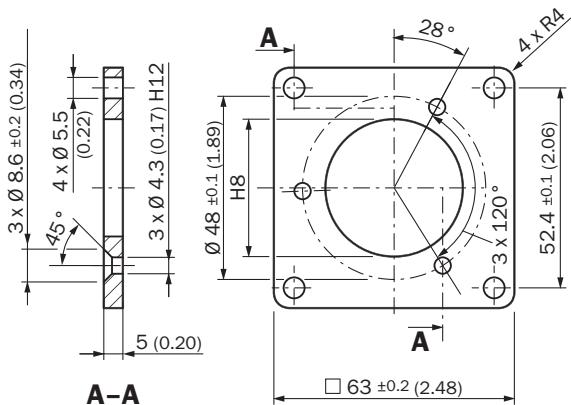
All dimensions in mm (inch)

Mounting bells

- Mounting bells incl. mounting kit for encoder with servo flange.

Flange, spigot	Type	Part no.
50 mm diameter	BEF-MG-50	5312987

BEF-MG-50
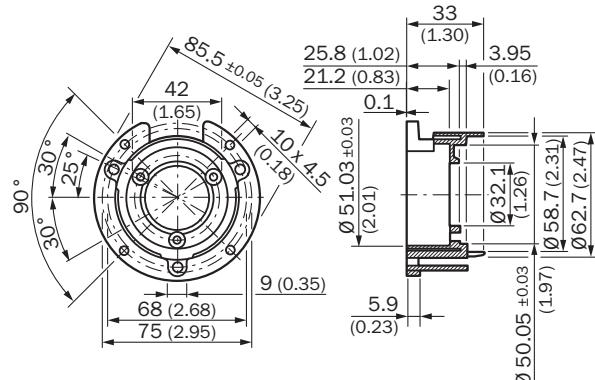
All dimensions in mm (inch)

Mounting bracket

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

Flange, spigot	Type	Part no.
36 mm diameter	BEF-WF-36	2029164

BEF-WF-36
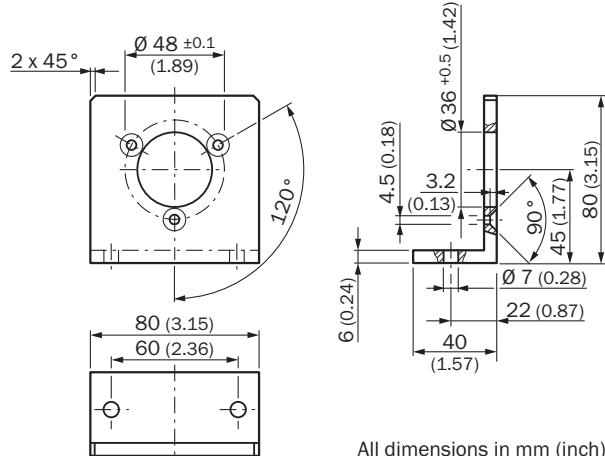
All dimensions in mm (inch)

Servo clamps

Description	Type	Part no.
Servo clamp half-shell, kit (containing 2 pce.) for servo flanges with spigot 50 mm diameter	BEF-WG-SF050	2029165
Small servo clamp, kit (containing 3 pce.) for servo flanges	BEF-WK-SF	2029166

BEF-WG-SF050
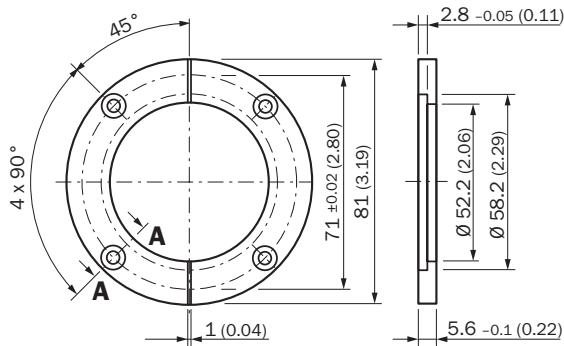
All dimensions in mm (inch)

BEF-WK-SF
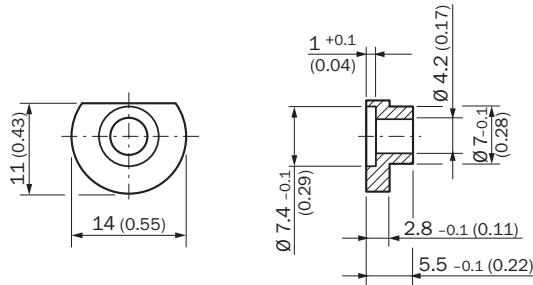
All dimensions in mm (inch)

Bearing blocks

Description	Type	Part no.
Bearing block designed for large radial and axial shaft loading, permissible radial and axial shaft loading 100 N	BEF-FA-B12-010	2042728

BEF-FA-B12-010
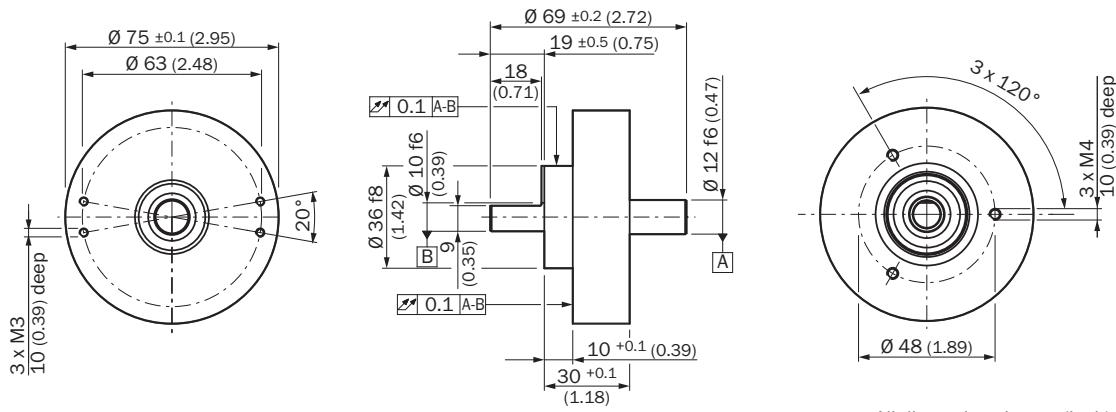
All dimensions in mm (inch)

Measuring wheels

- 200 mm circumference

| Description	Type	Part no.
Measuring wheels with a circumference of 200 mm for encoder shafts of 10 mm diameter, plastic (Hytrel) coating, plastic wheel body with aluminum hub, smooth surface	BEF-MR-010020	5312988
Measuring wheels with a circumference of 200 mm for encoder shafts of 10 mm diameter, plastic (Hytrel) coating, plastic wheel body with aluminum hub, corrugated surface	BEF-MR-010020G	5318678

BEF-MR-010020
BEF-MR-010020G
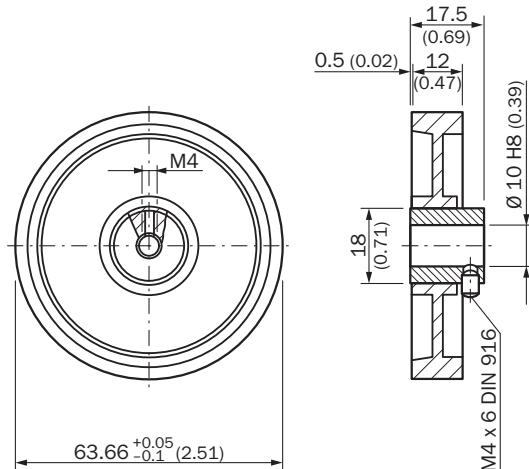
All dimensions in mm (inch)

- 500 mm circumference

Description	Type	Part no.
Measuring wheels with a circumference of 500 mm for encoder shafts of 10 mm diameter, plastic (Hytrel) coating, plastic wheel body with aluminum hub, smooth surface	BEF-MR-010050	5312989

BEF-MR-010050
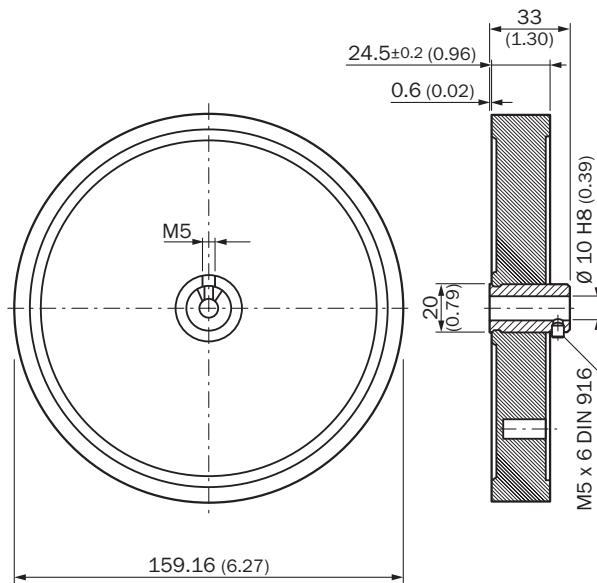
All dimensions in mm (inch)

- 200 mm circumference

Description	Type	Part no.
200 mm circumference measuring wheels for encoder shafts with a diameter of 6 mm, O-ring NBR70 surface	BEF-MR006020R	2055222
200 mm circumference measuring wheels for encoder shafts with a diameter of 8 mm, O-ring NBR70 surface	BEF-MR008020R	2055223
200 mm circumference measuring wheels for encoder shafts with a diameter of 10 mm, O-ring NBR70 surface	BEF-MR010020R	2055224

BEF-MR006020R
BEF-MR008020R
BEF-MR010020R
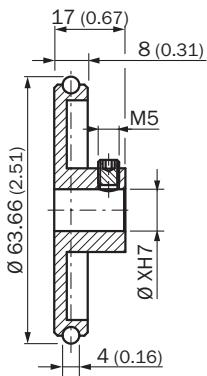
All dimensions in mm (inch)

- 300 mm circumference

Description	Type	Part no.
300 mm circumference measuring wheels for encoder shafts with a diameter of 6 mm, O-ring NBR70 surface	BEF-MR006030R	2055634
300 mm circumference measuring wheels for encoder shafts with a diameter of 8 mm, O-ring NBR70 surface	BEF-MR008030R	2055635
300 mm circumference measuring wheels for encoder shafts with a diameter of 10 mm, O-ring NBR70 surface	BEF-MR010030R	2049278

BEF-MR006030R
**BEF-MR008030R**
BEF-MR010030R
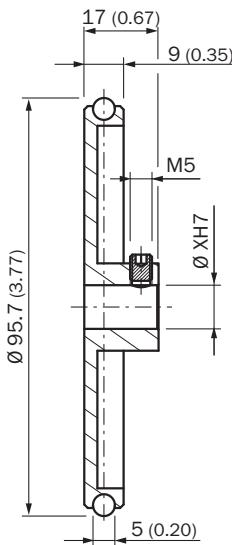
All dimensions in mm (inch)

- 500 mm circumference

Description	Type	Part no.
500 mm circumference measuring wheels for encoder shafts with a diameter of 6 mm, O-ring NBR70 surface	BEF-MR006050R	2055225
500 mm circumference measuring wheels for encoder shafts with a diameter of 8 mm, O-ring NBR70 surface	BEF-MR008050R	2055226
500 mm circumference measuring wheels for encoder shafts with a diameter of 10 mm, O-ring NBR70 surface	BEF-MR010050R	2055227

BEF-MR006050R
BEF-MR008050R
BEF-MR010050R
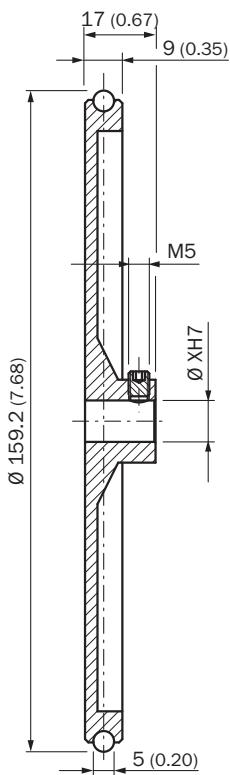
All dimensions in mm (inch)

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Accessories
Spare part
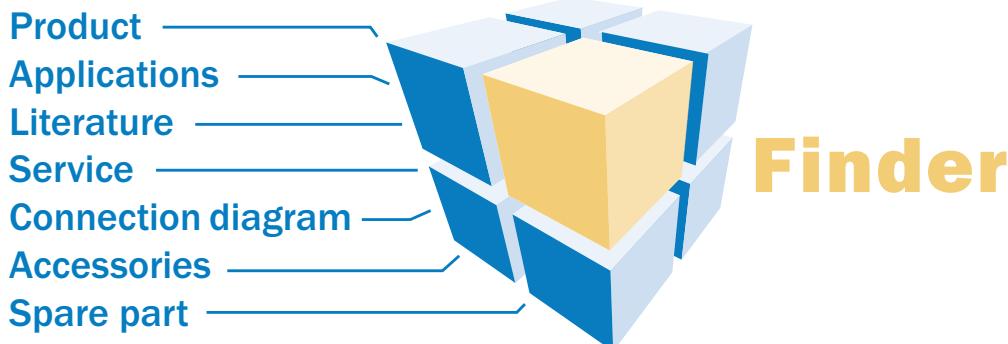
Finder

Product Finder: We can help you to quickly target the product that best matches your application.

Applications Finder: Select the application description on the basis of the challenge posed, industrial sector, or product group.

Literature Finder: Go directly to the operating instructions, technical information, and other literature on all aspects of SICK products.

These and other Finders at www.mysick.com

Efficiency – with SICK e-commerce tools

Partner Portal
www.mysick.com

Clearly structured: You can find everything you need for your sensor planning under the menu items Products, Information, and My Account.

Available 24 hours a day: Regardless of where you are in the world or what you'd like to know – everything is just a click away at www.mysick.com.

Safe: Your data is password-protected and only visible to you. With the individual user management, you define who can see what data and who can execute what actions.

Find out prices and availability
Determine the price and possible delivery date of your desired product simply and quickly.

Request or view a quote
You can have a quote generated online here.
Every quote is confirmed to you via e-mail.

Order online
You can go through the ordering process in just a few steps.

SICK at a glance
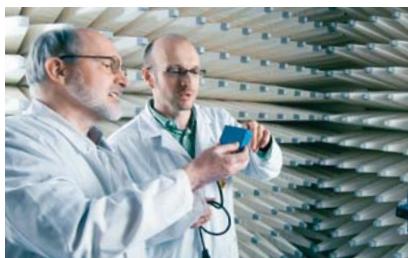
Leading technologies

With a staff of more than 5,000 and over 50 subsidiaries and representations worldwide, SICK is one of the leading and most successful manufacturers of sensor technology. The power of innovation and solution competency have made SICK the global market leader. No matter what the project and industry may be, talking with an expert from SICK will provide you with an ideal basis for your plans – there is no need to settle for anything less than the best.

Unique product range

- Non-contact detecting, counting, classifying, positioning and measuring of any type of object or media
- Accident and operator protection with sensors, safety software and services
- Automatic identification with bar code and RFID readers
- Laser measurement technology for detecting the volume, position and contour of people and objects
- Complete system solutions for analysis and flow measurement of gases and liquids

Comprehensive services

- SICK LifeTime Services – for safety and productivity
- Application centers in Europe, Asia and North America for the development of system solutions under real-world conditions
- E-Business Partner Portal www.mysick.com – price and availability of products, requests for quotation and online orders

Worldwide presence with subsidiaries in the following countries:

Australia
Belgium/Luxembourg
Brazil
Ceská Republika
Canada
China
Danmark
Deutschland
España
France
Great Britain
India
Israel
Italia
Japan

México
Nederland
Norge
Österreich
Polska
România
Russia
Schweiz
Singapore
Slovenija
South Africa
South Korea
Suomi
Sverige
Taiwan
Türkiye
United Arab Emirates
USA

Please find detailed addresses and additional representatives and agencies in all major industrial nations at
www.sick.com

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