HIGH RESOLUTION, PROGRAMMABLE ENCODER FOR DEMANDING APPLICATIONS

Product description

The DFS60 is a high-resolution incremental encoder with a diameter of 60 mm. It offers a wide variety of mechanical and electric interfaces and can also be programmed by the customer if required. Programming of the output signal and zero pulse is a unique feature for the market. The high enclosure rating, wide temperature range, and large ball bearing distance ensure extreme reliability, making the DFS60 the ideal encoder for industrial applications in harsh environments.

At a glance

- Short installation depth
- High resolution of up to 16 bits
- Optional programming: output voltage, zero pulse position, zero impulse width and pulse count.
- Connection: radial or axial cable outlet, M23 or M12 male connector, axial or radial.
- Electrical interfaces: 5 V & 24 V TTL/RS-422, 24 V HTL/Push Pull
- Mechanical interfaces: face mount flange or servo flange, blind hollow shaft or through hollow shaft
- Remote zero set possible

Your benefits

- Reduction of storage costs and downtimes due to programmability by the customer
- The wide range of different mechanical and electrical interfaces enables the optimum adaptation of the encoder to the application-specific installation situation
- Excellent concentricity even at high speeds
- High resolution of up to 16 bits ensures precise measurements for demanding applications
- Long-term and reliable operation thanks to a high enclosure rating, temperature resistance and bearing lifetime
- The ability to program using the PGT-08-S programming software and the PGT-10-Pro display programming device enables fast and flexible adaptation of the encoder to customer requirements
- Programmable zero pulse position simplifies installation

Additional information

8015560/2015-09-01
Subject to change without notice

Fields of application

- Applications in factory and logistics automation for measuring position, speed, and distance: e.g., in printing machines, textile machines, wood processing, packaging machinery

Detailed technical data

Performance

	Eco	Basic	Advanced
Pulses per revolution [1) 2)]	100 ... 2,048	1 ... 10,000	1 ... 65,536
Pulses per revolution at sin/cos 1.0 V_{ss}	–	1,024	–
Measurement step	90° electrical/pulses per revolution		
Measuring step deviation at non-binary number of lines			
Pulses 1 ... 99	–	± 0.08°	± 0.04°
Pulses 100 ... 10,000	± 0.2°	± 0.01°	± 0.008°
Pulses > 10,000	–		± 0.002°
Measuring step deviation at binary number of lines			
Pulses 1 ... 64	–	± 0.05°	± 0.03°
Pulses 128 ... 8,192	± 0.15°	± 0.008°	± 0.008°
Pulses 16,384 ... 65,536	–		± 0.0015°
Reference signal			
Number	1		
Location	90°, electric, logically gated with A and B/sine and cosine		
Error limits	± 0.3°	± 0.05°	± 0.03°

[1)] See maximum viewing number of resolutions

[2)] For a detailed list see “Pulses per revolution”

[3)] Under mechanical zero set width.

Electrical data

	Eco	Basic	Advanced
Electrical interface	4.5 V ... 5.5 V, TTL/RS422		
	10 V ... 32 V, HTL/Push Pull		
	10 V ... 32 V, TTL/RS422		
	–	4.5 V ... 5.5 V, sin/cos 1.0 V_{SS}	
	–	4.5 V ... 32 V, HTL/Push Pull, 0-SET on M23 male connector [2)]	
	–	4.5 V ... 5.5 V, TTL/RS422, 0-SET on M23 male connector [2)]	
	–	4.5 V ... 32 V, TTL/RS422, 0-SET on M23 male connector [2)]	
	–	4.5 V ... 32 V, TTL/HTL programmable [1)]	
	–	4.5 V ... 32 V, TTL/HTL programmable, 0-SET on M23 male connector [1) 2)]	

[1)] Factory setting, output level TTL.

[2)] Only with device variants with M23 male connector outlet in conjunction with the electrical interfaces M,U,V and W.

[3)] Under mechanical zero set width.

[4)] The universal cable outlet is positioned so that it is possible to lay it without bends in a radial or axial direction.

[5)] Short-circuit of another channel U_S or GND permissible for a maximum of 30 s.

[6)] Short-circuit of another channel or GND permissible for a maximum of 30 s.

[7)] TTL programming with ≥ 5.5 V: Short-circuit of another channel or GND permissible for a maximum of 30 s.

[8)] HTL or TTL programming with< 5.5 V: Short-circuit of another channel, U_S or GND permissible for a maximum of 30 s.

[9)] 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 devices, average ambient temperature 40 °C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

	Eco	Basic	Advanced
Initialization time after power on			
4.5 V ... 5.5 V, TTL/RS422	40 ms		
10 V ... 32 V, HTL/Push Pull	40 ms		
10 V ... 32 V, TTL/RS422	40 ms		
4.5 V ... 5.5 V, sin/cos 1.0 V_{SS}	–	40 ms	–
4.5 V ... 32 V, HTL/Push Pull, 0-SET	–	Max. 30 ms	
4.5 V ... 5.5 V, TTL/RS422, 0-SET	–	Max. 30 ms	
4.5 V ... 32 V, TTL/RS422, 0-SET	–	Max. 30 ms	
4.5 V ... 32 V, TTL/HTL programmable	–	Max. 30 ms/32 ms [3]	
4.5 V ... 32 V, TTL/HTL programmable, 0-SET	–	Max. 30 ms/32 ms [3]	
0-set function		H – active (L = 0 ... 3 V, H = 4 ... U_s V)	
Connection type	Cable, 8-wire, universal, 1.5 m [4] Cable, 8-wire, universal, 3 m [4] Cable, 8-wire, universal, 5 m [4] M12 male connector, 8-pin, radial M12 male connector, 8-pin, axial M23 male connector, 12-pin, radial M23 male connector, 12-pin, axial		
Max. load current	≤ 30 mA		
Operating current without load	40 mA		
Load resistance			
4.5 V ... 5.5 V, sin/cos 1.0 V_{SS}	–	min. 120 Ω	–
Max. power consumption without load			
10 V ... 32 V, HTL/Push Pull	0.5 W		
10 V ... 32 V, TTL/RS422	0.5 W		
4.5 V ... 32 V, HTL/Push Pull, 0-SET	–	0.7 W	
4.5 V ... 5.5 V, TTL/RS422, 0-SET	–	0.7 W	
4.5 V ... 32 V, TTL/RS422, 0-SET	–	0.7 W	
4.5 V ... 32 V, TTL/HTL programmable	–	0.7 W	
4.5 V ... 32 V, TTL/HTL programmable, 0-SET	–	0.7 W	
Maximum output frequency			
TTL/RS422	300 kHz	600 kHz	820 kHz
HTL/Push Pull	300 kHz	600 kHz	820 kHz
HTL/Push Pull, 0-SET	300 kHz	600 kHz	820 kHz
TTL/RS422, 0-SET	300 kHz	600 kHz	820 kHz
TTL/HTL programmable	–	600 kHz	820 kHz
Sin/cos 1.0 V_{SS}	–	200 kHz	–
TTL/HTL programmable, 0-SET	–	600 kHz	820 kHz

[1] Factory setting, output level TTL.

[2] Only with device variants with M23 male connector outlet in conjunction with the electrical interfaces M,U,V and W.

[3] Under mechanical zero set width.

[4] The universal cable outlet is positioned so that it is possible to lay it without bends in a radial or axial direction.

[5] Short-circuit of another channel U_S or GND permissible for a maximum of 30 s.

[6] Short-circuit of another channel or GND permissible for a maximum of 30 s.

[7] TTL programming with ≥ 5.5 V: Short-circuit of another channel or GND permissible for a maximum of 30 s.

[8] HTL or TTL programming with< 5.5 V: Short-circuit of another channel, U_S or GND permissible for a maximum of 30 s.

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	Eco	Basic	Advanced
Reverse polarity protection			
4.5 V...5.5 V, TTL/RS422	–		
10 V ... 32 V, HTL/Push Pull	✔		
10 V ... 32 V, TTL/RS422	✔		
4.5 V ... 5.5 V, sin/cos 1.0 V_{SS}	–		
4.5 V ... 32 V, HTL/Push Pull, 0-SET	–	✔	
4.5 V ... 5.5 V, TTL/RS422, 0-SET	–	✔	
4.5 V ... 32 V, TTL/RS422, 0-SET	–	✔	
4.5 V ... 32 V, TTL/HTL programmable	–	✔	
4.5 V ... 32 V, TTL/HTL programmable, 0-SET	–	✔	
Short-circuit protection of the outputs			
4.5 V–5.5 V, TTL/RS422	✔ [5]		
10 V ... 32 V, HTL/Push Pull	✔ [5]		
10 V ... 32 V, TTL/RS422	✔ [6]		
4.5 V ... 32 V, HTL/Push Pull, 0-SET	–	✔ [7]	
4.5 V ... 5.5 V, TTL/RS422, 0-SET	–	✔ [7]	
4.5 V ... 32 V, TTL/RS422, 0-SET	–	✔ [8]	
4.5 V ... 32 V, TTL/HTL programmable	–	✔ [7] [8]	
4.5 V ... 5.5 V, sin/cos 1.0 V_{SS}	–	✔ [5]	–
4.5 V ... 32 V, TTL/HTL programmable, 0-SET	–	✔ [7] [8]	
MTTFd: mean time to dangerous failure	300 years (EN ISO 13849-1) [9]		

[1] Factory setting, output level TTL.

[2] Only with device variants with M23 male connector outlet in conjunction with the electrical interfaces M,U,V and W.

[3] Under mechanical zero set width.

[4] The universal cable outlet is positioned so that it is possible to lay it without bends in a radial or axial direction.

[5] Short-circuit of another channel U_s or GND permissible for a maximum of 30 s.

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Mechanical data

	Eco	Basic	Advanced
Shaft diameter			
Face mount flange	6 mm x 10 mm [1]		
Servo flange	10 mm x 19 mm [1]		
Blind hollow shaft, through hollow shaft [2]	6 mm, 8 mm, 10 mm, 12 mm, 14 mm, 15 mm, 3/8", 1/2", 5/8"		
Mass [3]			
Solid shaft	0.3 kg		
Blind hollow shaft, through hollow shaft	0.2 kg		
Shaft material	Stainless steel		
Flange material	Aluminum [4]		
Housing material	Aluminum die cast [4]		

[1] Other diameter, lengths, and spread shafts on request.

[2] Clamping on the back of the shaft on request.

[3] Relates to devices with cable outlet.

[4] Stainless steel on request.

[5] Take into account self-heating of 3.3 K per 1,000 revolutions/min when designing the operating temperature range.

	Eco	Basic	Advanced
Start up torque			
Solid shaft	0.5 Ncm (+20 °C)		
Blind hollow shaft, through hollow shaft	0.8 Ncm (+20 °C)		
Operating torque			
Solid shaft	0.3 Ncm (+20 °C)		
Blind hollow shaft, through hollow shaft	0.6 Ncm (+20 °C)		
Permissible shaft movement, axial static/ dynamic			
Blind hollow shaft, through hollow shaft	± 0.5 mm, ± 0.2 mm		± 0.5 mm, ± 0.01 mm
Permissible shaft movement, radial static/ dynamic			
Blind hollow shaft, through hollow shaft	± 0.3 mm, ± 0.1 mm		± 0.3 mm, ± 0.05 mm
Permissible shaft loading			
Solid shaft	80 N (radial) 40 N (axial)		
Maximum operating speed			
Solid shaft	9,000 / min [5]		
Blind hollow shaft, through hollow shaft	6,000 / min [5]		
Rotor moment of inertia			
Solid shaft	6.2 gcm²		
Blind hollow shaft, through hollow shaft	40 gcm²		
Bearing lifetime	3.6 x 10^{10} revolutions		
Max. angular acceleration	5 x 10^{5} rad/s²		

[1] Other diameter, lengths, and spread shafts on request.
[2] Clamping on the back of the shaft on request.
[3] Relates to devices with cable outlet.
[4] Stainless steel on request.
[5] Take into account self-heating of 3.3 K per 1,000 revolutions/min when designing the operating temperature range.

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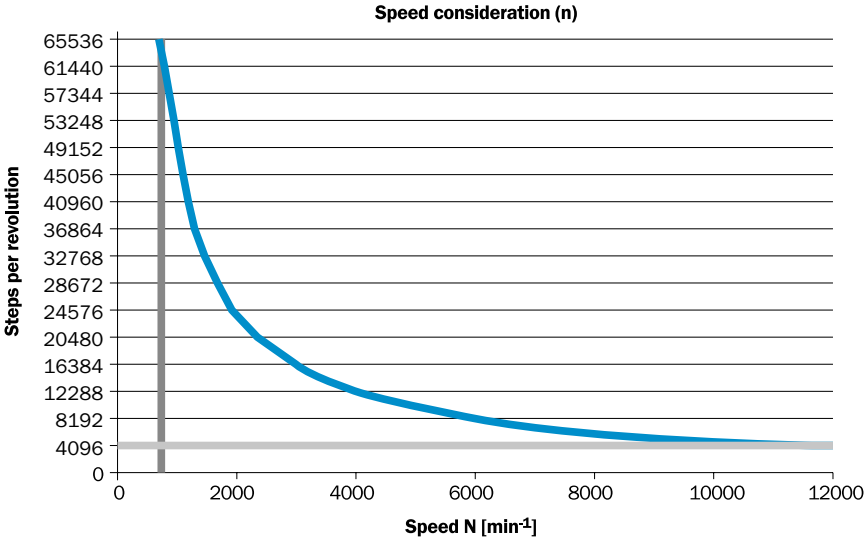
Ambient data

	Eco	Basic	Advanced
EMC [1]	According to EN 61000-6-2 and EN 61000-6-3		
Enclosure rating as per IEC 60529			
On the shaft	IP 65 [2]		
On the housing, male connector outlet [3]	IP 67 (IP 65 for through hollow shaft)		
On the housing, cable outlet	IP 67 (IP 65 for through hollow shaft)		
Permissible relative humidity	90% (condensation of optical surfaces not permitted)		
Operating temperature range	0 °C ... +85 °C	–40 °C ... +100 °C [4] –30 °C ... +100 °C [5]	
Storage temperature range	–40 °C ... +100 °C, without packaging		
Resistance to shocks according to EN 60068-2-27	50 g	70 g	100 g
Resistance to vibration according to EN 60068-2-6	20 g, 10 Hz ... 2,000 Hz	30 g, 10 Hz ... 2,000 Hz	

[1] For interfaces 10 ... 32 V, TTL/RS422 and 10 ... 32 V, HTL/Push Pull according to EN 61000-6-2 and EN 61000-6-4, devices in class A
[2] IP 67 on request.
[3] When mating connector is inserted.
[4] When cables are fixed in place.
[5] When cables can be moved.

Viewing number of resolutions



Type code

Solid shaft, programmable

Type
- B: Pulses per revolution, programmable, 1 ... 10,000
- A: Pulses per revolution, programmable, 1 ... 65,536

Mechanical design
- 4: Face mount flange, solid shaft 10 x 19 mm
- 1: Servo flange, solid shaft 6 x 10 mm

Electrical interface (factory setting: output level TTL)
- P: 4.5 V ... 32 V, TTL/HTL programmable
- M: 4.5 ... 32 V, TTL or HTL programmable with 0-set function on PIN 7 on M23 male connector. (Only in combination with connection type A or B)

Connection type
- A: Male connector M23, 12-pin, radial
- B: Male connector M23, 12-pin, axial
- C: Male connector M12, 8-pin, radial
- D: Male connector M12, 8-pin, axial
- K: Cable, 8-wire, universal, 1.5 m [1)]
- L: Cable, 8-wire, universal, 3 m [1)]
- M: Cable, 8-wire, universal, 5 m [1)]
- N: Cable, 8-wire, universal, 10 m [1)]

Resolution
(Factory setting for pulses per revolution for type B: 10,000; 65,536 for type A)
Always use 5 digits in clear text, see “Pulses per revolution”

D	F	S	6	0		-	S								

[1)] The universal cable outlet is positioned so that it is possible to lay it without bends in a radial and axial direction.

The following features can be programmed:

Pulses per revolution from 1 ... 65,536 using the programming tools PGT-08-S or PGT-10-Pro

Electrical zero-pulse width 90°, 180°, 270° using the programming tools PGT-08-S or PGT-10-Pro

Mechanical zero-pulse width 1° ... 359° using the programming tool PGT-10-Pro

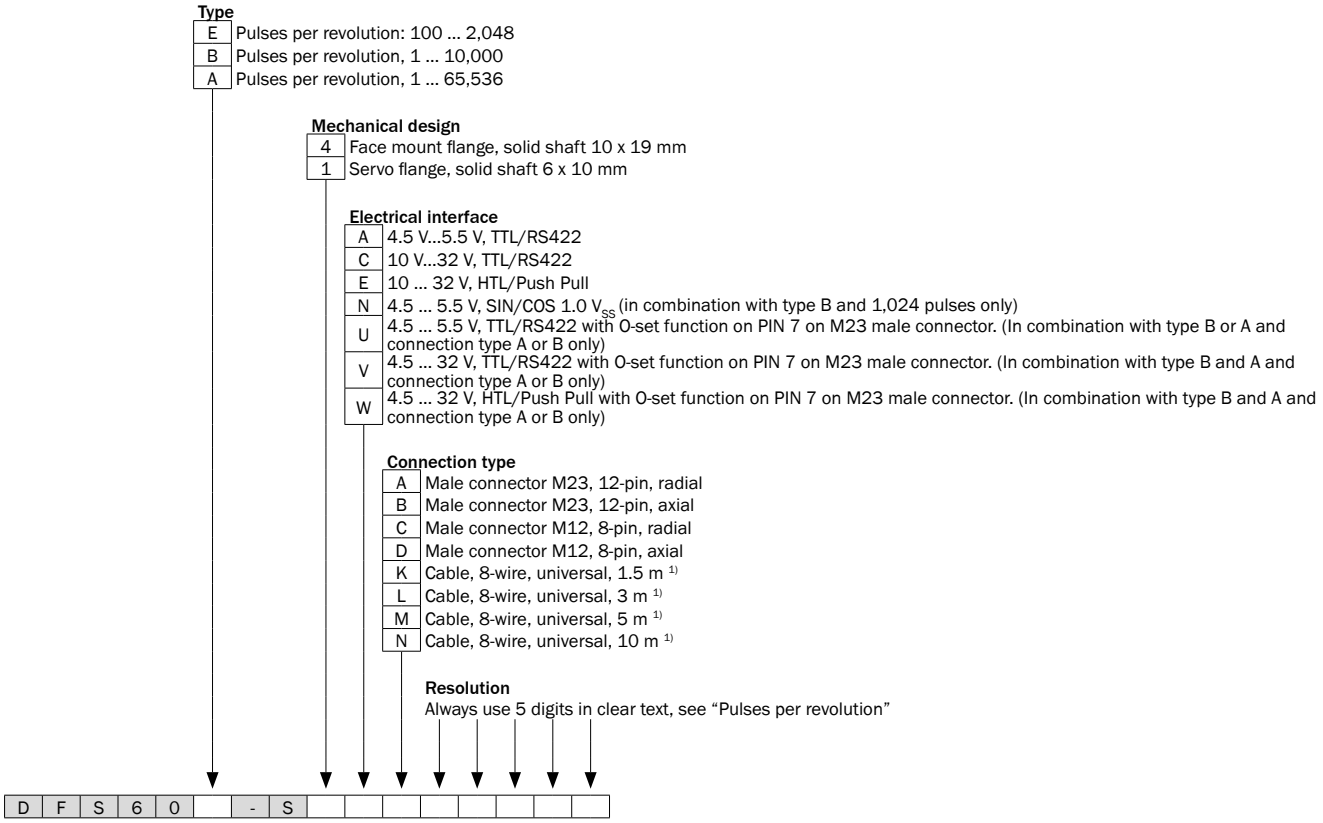
Output voltage levels for TTL or HTL using the programming tools PGT-08-S or PGT-10-Pro

Counting direction CW/CCW using the programming tools PGT-08-S or PGT-10-Pro

0-SET function using the programming tools PGT-08-S or PGT-10-Pro

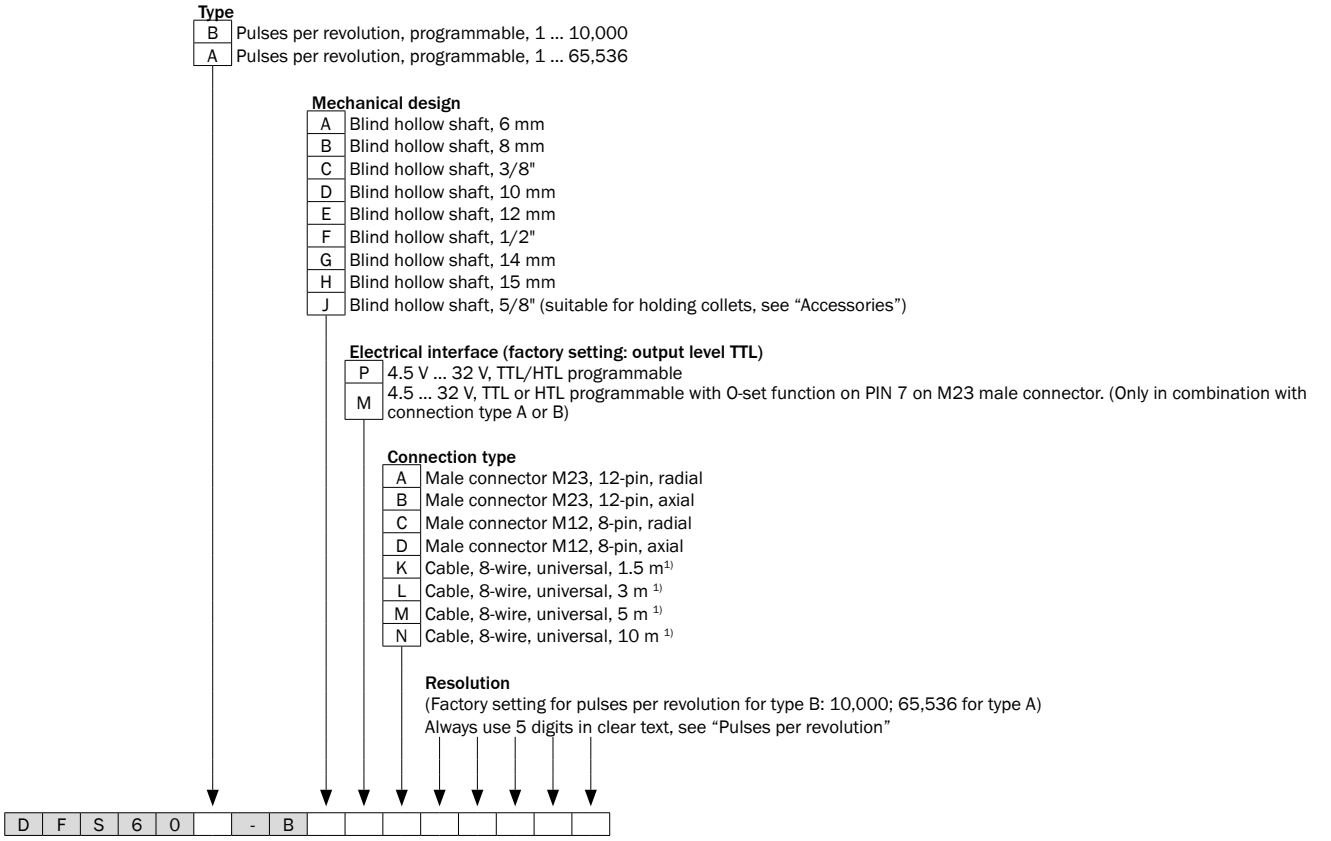
0-SET function via PIN 7 of the M23 male connector by applying U_s for at least 250 ms.

Solid shaft, not programmable



1) The universal cable outlet is positioned so that it is possible to lay it without bends in a radial and axial direction.

Blind hollow shaft, programmable



1) The universal cable outlet is positioned so that it is possible to lay it without bends in a radial and axial direction.

The following features can be programmed:
Pulses per revolution from 1 ... 65,536 using the programming tools PGT-08-S or PGT-10-Pro
Electrical zero-pulse width 90°, 180°, 270° using the programming tools PGT-08-S or PGT-10-Pro
Mechanical zero-pulse width 1° ... 359° using the programming tool PGT-10-Pro
Output voltage levels for TTL or HTL using the programming tools PGT-08-S or PGT-10-Pro
Counting direction CW/CCW using the programming tools PGT-08-S or PGT-10-Pro
0-SET function using the programming tools PGT-08-S or PGT-10-Pro
0-SET function via PIN 7 of the M23 male connector by applying U_s for at least 250 ms.

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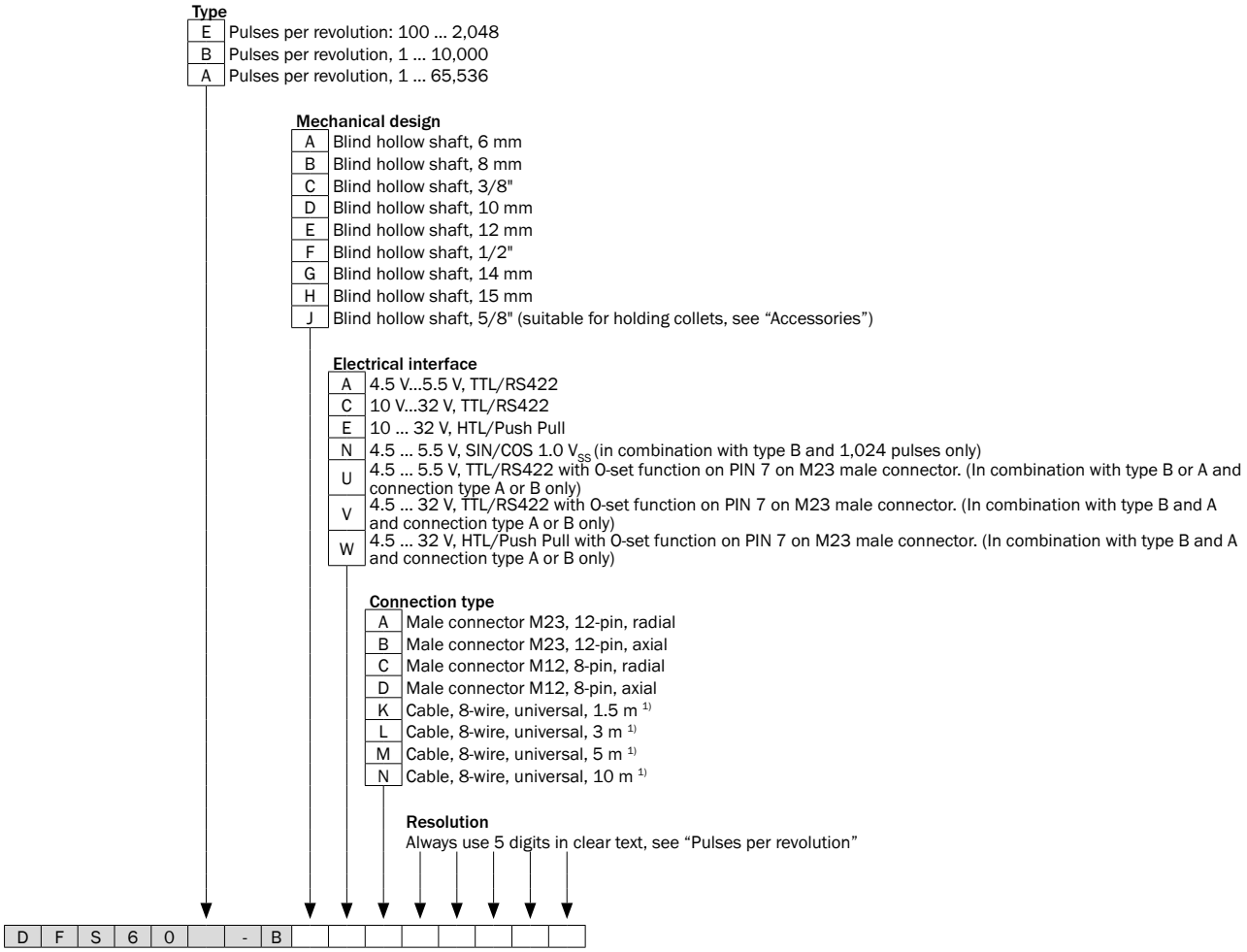
Blind hollow shaft, not programmable



1) The universal cable outlet is positioned so that it is possible to lay it without bends in a radial and axial direction.

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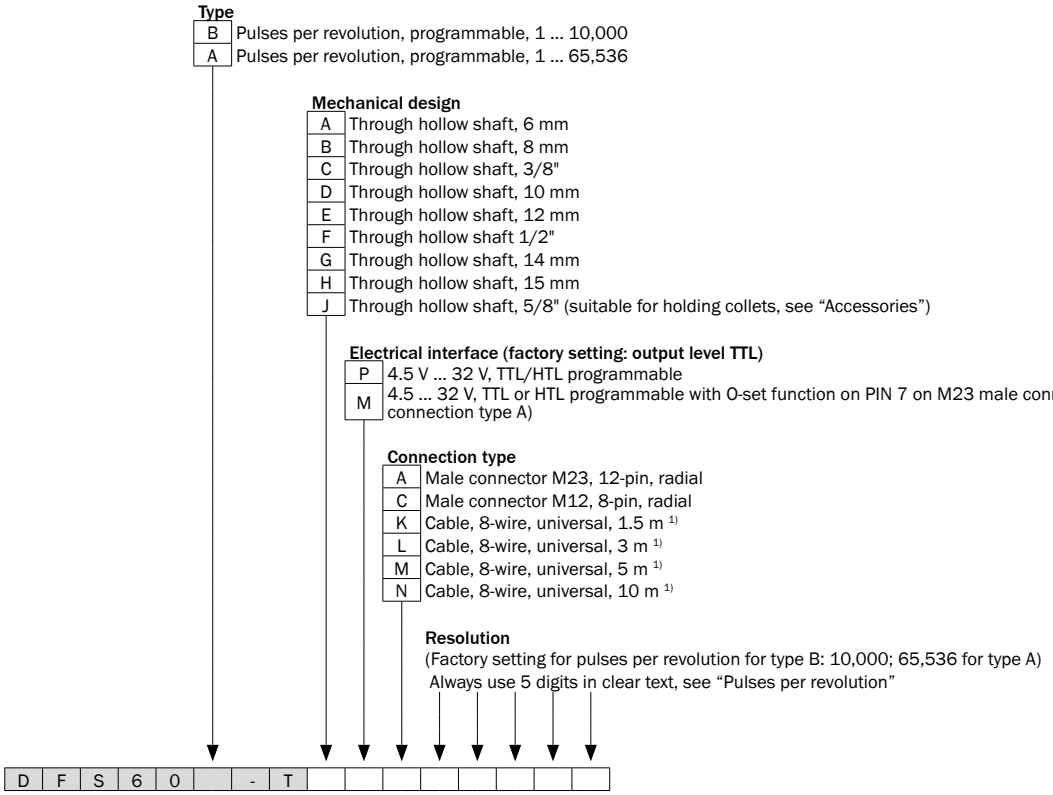
Through hollow shaft, programmable



1) The universal cable outlet is positioned so that it is possible to lay it without bends in a radial and axial direction.

The following features can be programmed:

Pulses per revolution from 1 ... 65,536 using the programming tools PGT-08-S or PGT-10-Pro

Electrical zero-pulse width 90°, 180°, 270° using the programming tools PGT-08-S or PGT-10-Pro

Mechanical zero-pulse width 1° ... 359° using the programming tool PGT-10-Pro

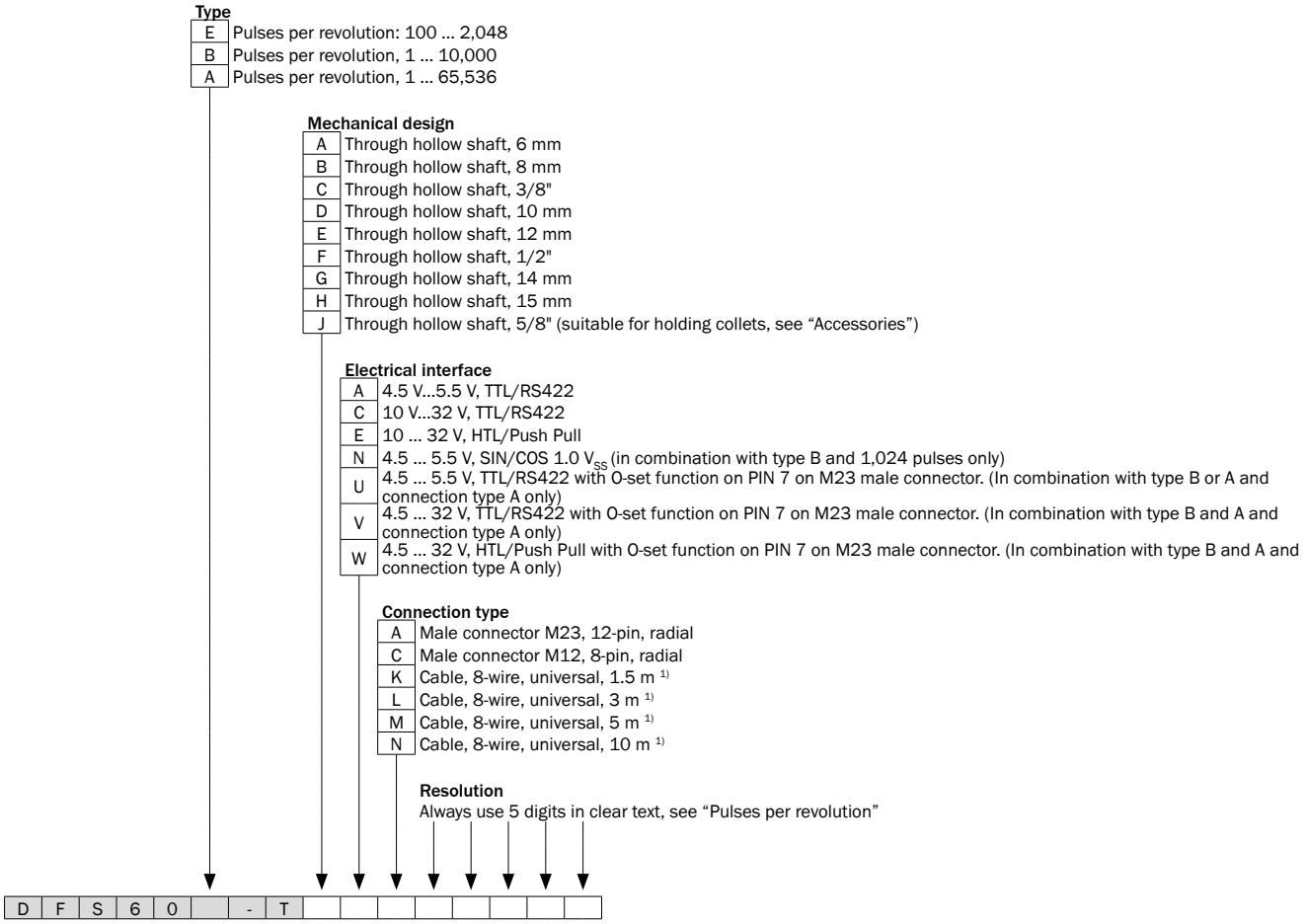
Output voltage levels for TTL or HTL using the programming tools PGT-08-S or PGT-10-Pro

Counting direction CW/CCW using the programming tools PGT-08-S or PGT-10-Pro

0-SET function using the programming tools PGT-08-S or PGT-10-Pro

0-SET function via PIN 7 of the M23 male connector by applying U_s for at least 250 ms

Through hollow shaft, not programmable



1) The universal cable outlet is positioned so that it is possible to lay it without bends in a radial and axial direction.

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Pulses per revolution [1)]

	E	B [2)]	A [2)]
Pulses per revolution	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

[1)] The electrical interface N (Sin/Cox 1.0 V_{SS}) can only be ordered with 1,024 pulses per revolution.

[2)] Additional available upon request.

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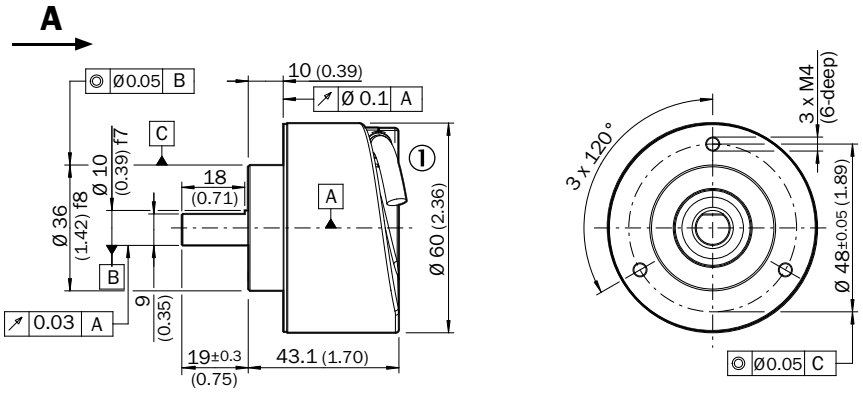
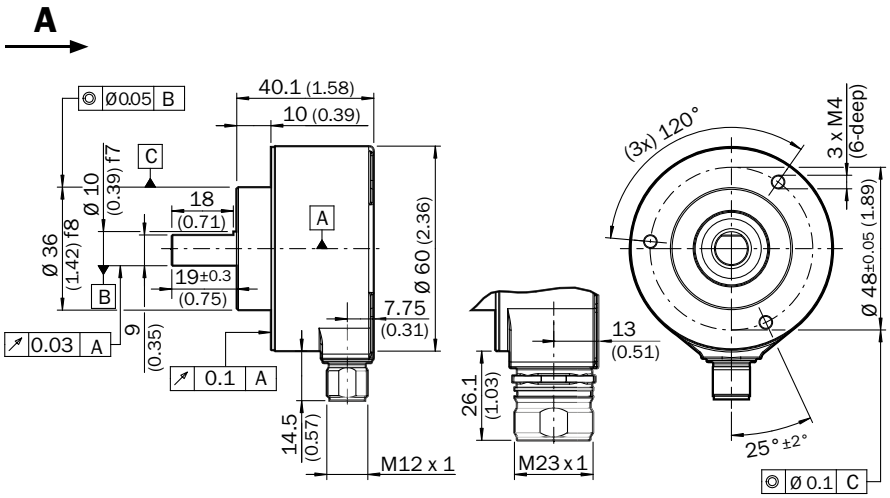
Dimensional drawings (dimensions in mm)

Face mount flange, cable output



General tolerances according to ISO 2768-mk
① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

Face mount flange, radial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

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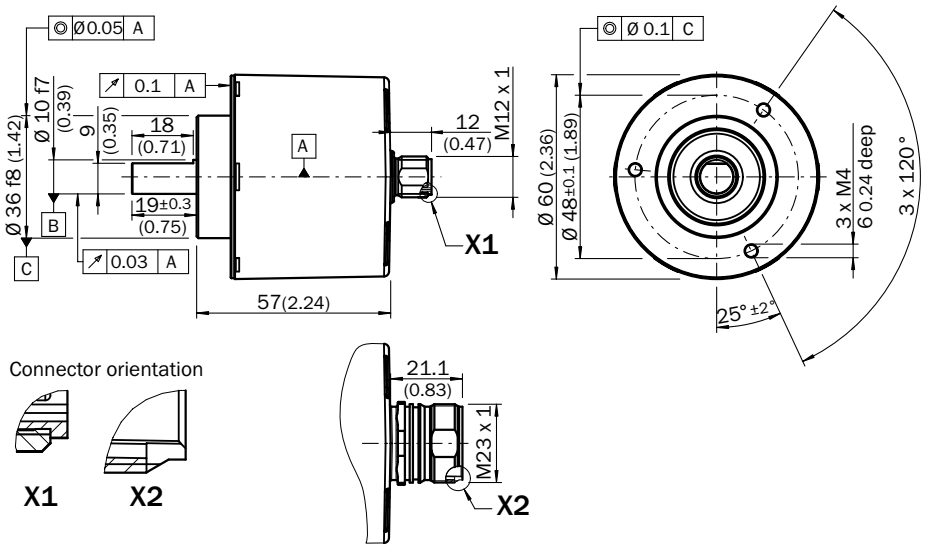
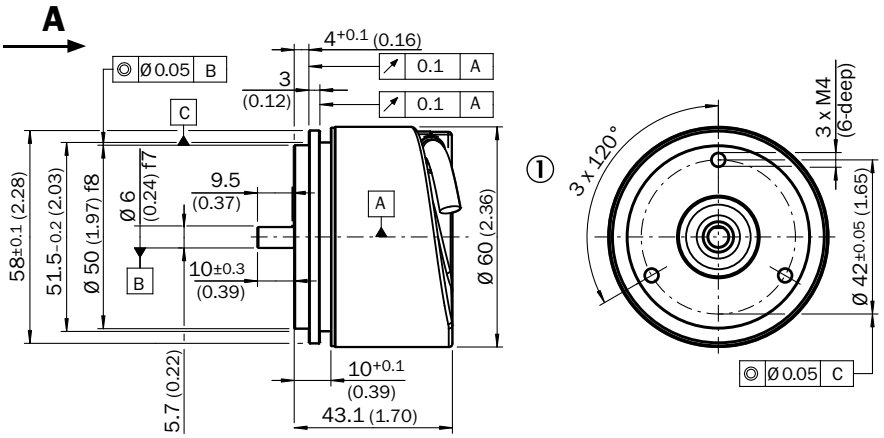
Face mount flange, axial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

Servo flange, cable outlet



General tolerances according to ISO 2768-mk
① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

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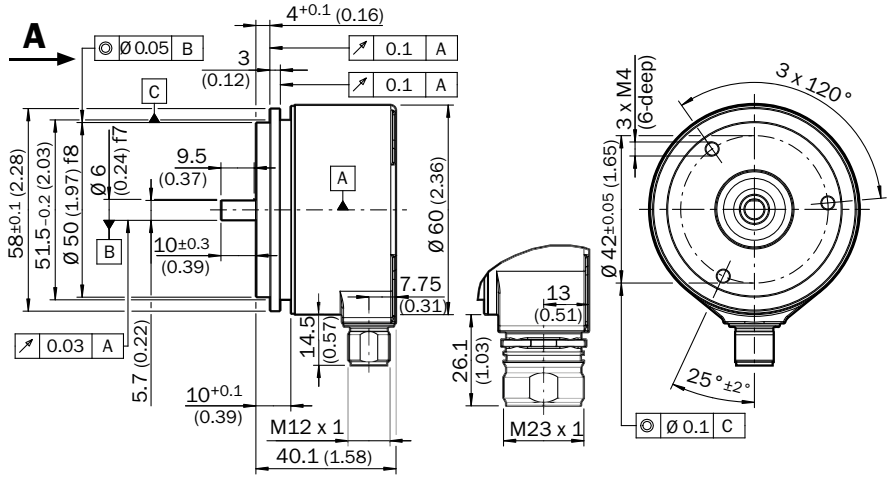
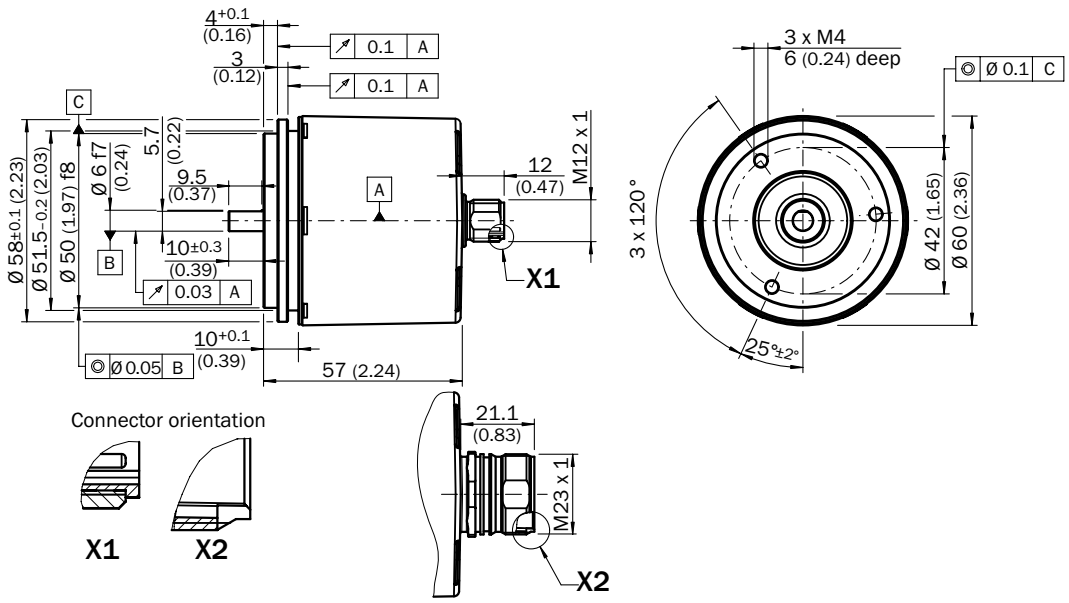
Servo flange, radial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

Servo flange, axial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

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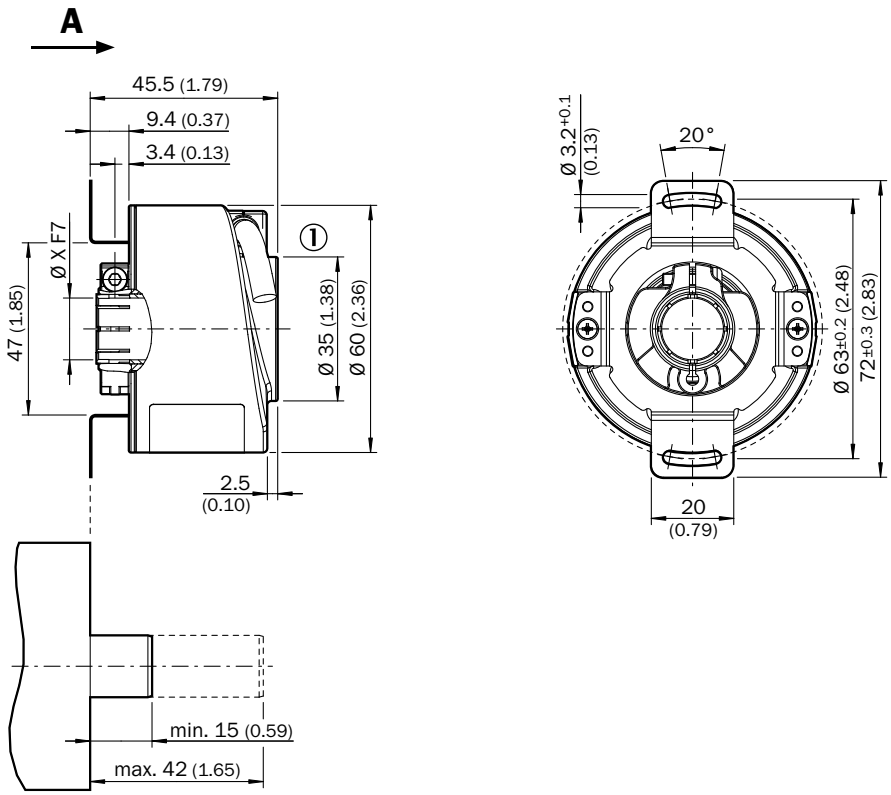
Blind hollow shaft, cable outlet



General tolerances according to ISO 2768-mk
① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

Type Blind hollow shaft	XF7 shaft diameter	xj7 shaft diameter
DFS60x-BAxxxxxxxx	6 mm	Provided by customer
DFS60x-BBxxxxxxxx	8 mm	
DFS60x-BCxxxxxxxx	3/8“	
DFS60x-BDxxxxxxxx	10 mm	
DFS60x-BExxxxxxxx	12 mm	
DFS60x-BFxxxxxxxx	1/2“	
DFS60x-BGxxxxxxxx	14 mm	
DFS60x-BHxxxxxxxx	15 mm	
DFS60x-BJxxxxxxxx	5/8“	

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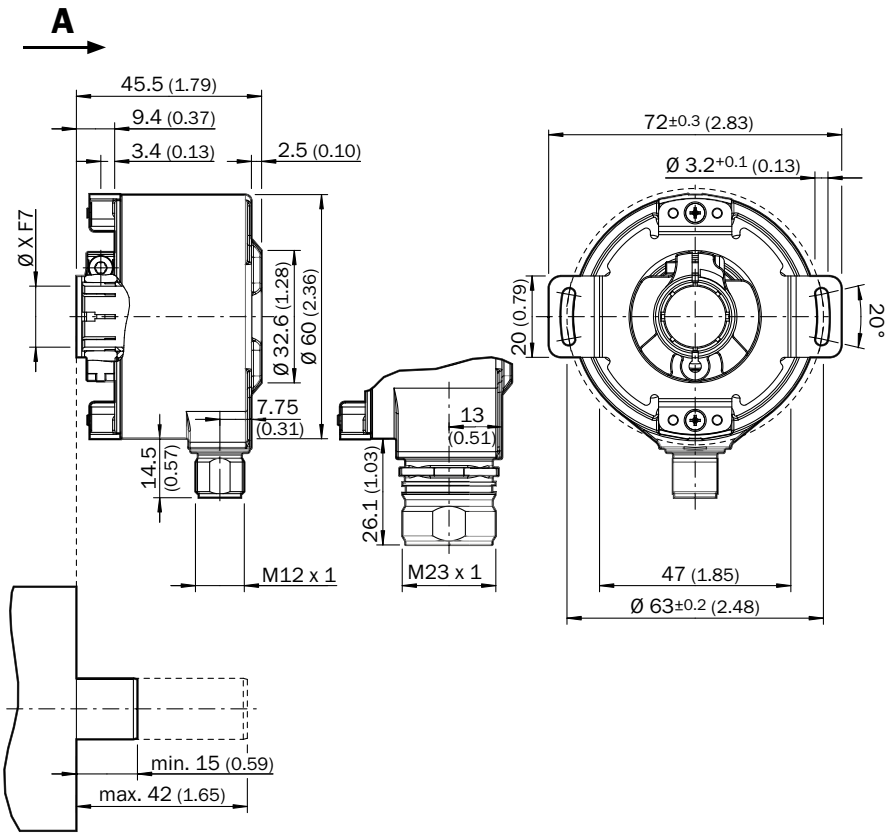
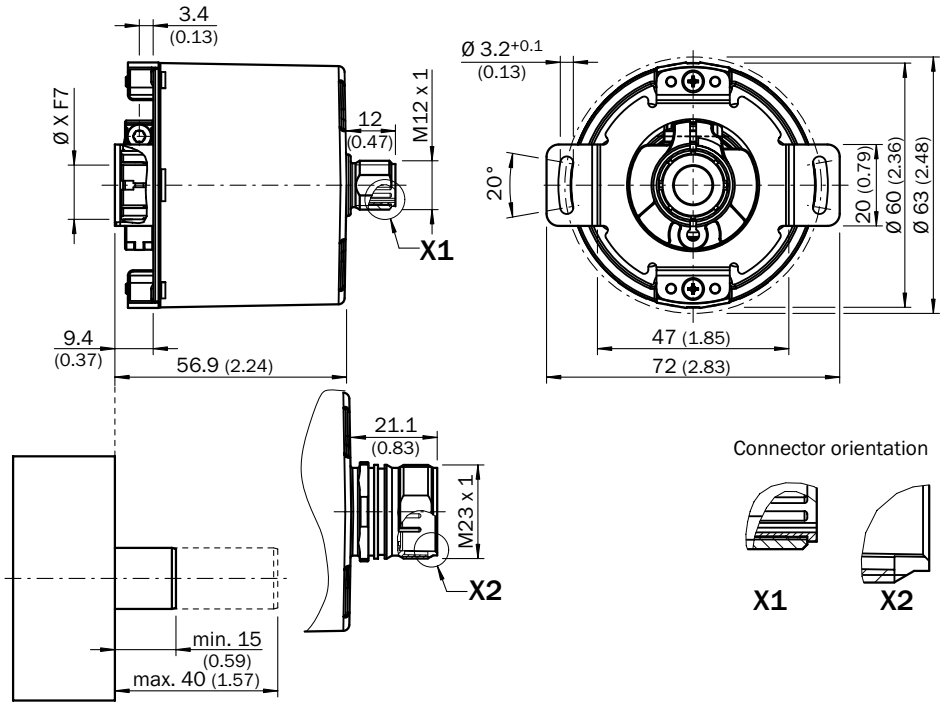
Blind hollow shaft, radial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

Type Blind hollow shaft	XF7 shaft diameter	xj7 shaft diameter
DFS60x-BAxxxxxxxx	6 mm	Provided by customer
DFS60x-BBxxxxxxxx	8 mm	
DFS60x-BCxxxxxxxx	3/8“	
DFS60x-BDxxxxxxxx	10 mm	
DFS60x-BExxxxxxxx	12 mm	
DFS60x-BFxxxxxxxx	1/2“	
DFS60x-BGxxxxxxxx	14 mm	
DFS60x-BHxxxxxxxx	15 mm	
DFS60x-BJxxxxxxxx	5/8“	

Blind hollow shaft, axial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

Type Blind hollow shaft	XF7 shaft diameter	xj7 shaft diameter
DFS60x-BAxxxxxxxx	6 mm	Provided by customer
DFS60x-BBxxxxxxxx	8 mm	
DFS60x-BCxxxxxxxx	3/8“	
DFS60x-BDxxxxxxxx	10 mm	
DFS60x-BExxxxxxxx	12 mm	
DFS60x-BFxxxxxxxx	1/2“	
DFS60x-BGxxxxxxxx	14 mm	
DFS60x-BHxxxxxxxx	15 mm	
DFS60x-BJxxxxxxxx	5/8“	

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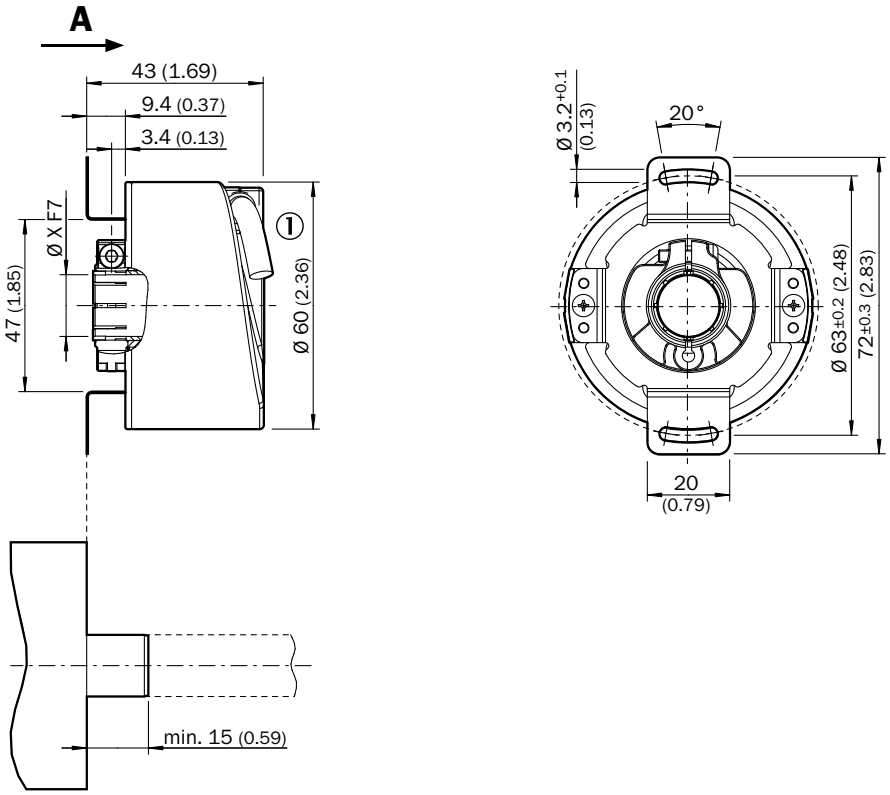
Through hollow shaft, cable outlet



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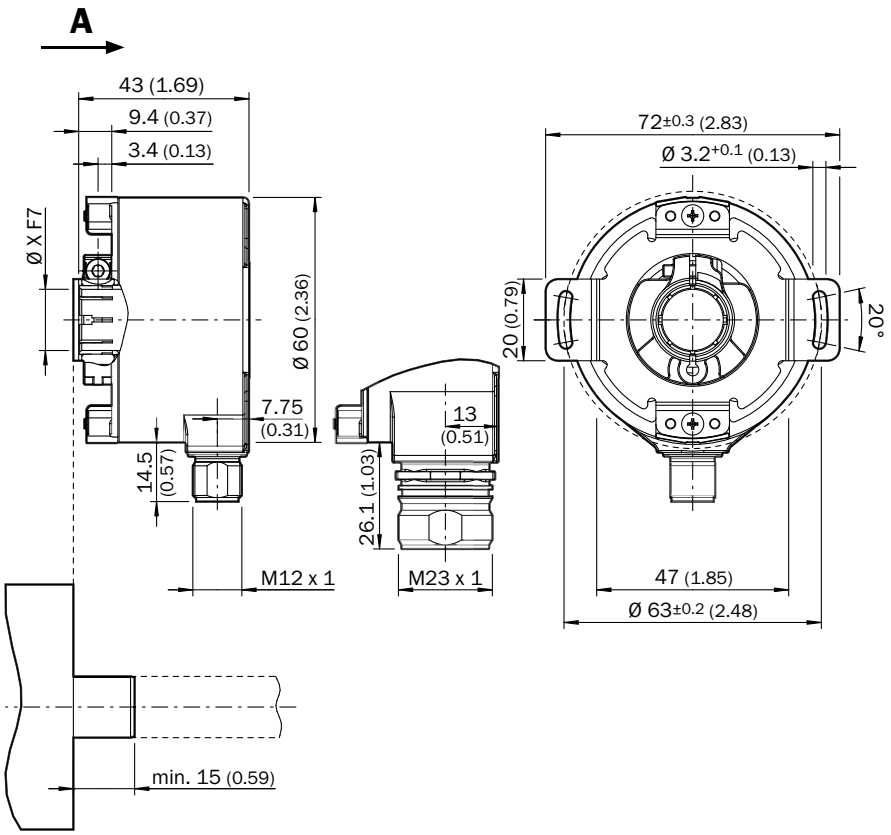
General tolerances according to ISO 2768-mk
① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

Type Through hollow shaft	XF7 shaft diameter	xj7 shaft diameter
DFS60x-TAxxxxxxxx	6 mm	Provided by customer
DFS60x-TBxxxxxxxx	8 mm	
DFS60x-TCxxxxxxxx	3/8“	
DFS60x-TDxxxxxxxx	10 mm	
DFS60x-TExxxxxxxx	12 mm	
DFS60x-TFxxxxxxxx	1/2“	
DFS60x-TGxxxxxxxx	14 mm	
DFS60x-THxxxxxxxx	15 mm	
DFS60x-TJxxxxxxxx	5/8“	

Through hollow shaft, radial cable outlet M12 and M23



General tolerances according to ISO 2768-mk

① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

Type Through hollow shaft	XF7 shaft diameter	xj7 shaft diameter
DFS60x-TAxxxxxxxx	6 mm	Provided by customer
DFS60x-TBxxxxxxxx	8 mm	
DFS60x-TCxxxxxxxx	3/8“	
DFS60x-TDxxxxxxxx	10 mm	
DFS60x-TExxxxxxxx	12 mm	
DFS60x-TFxxxxxxxx	1/2“	
DFS60x-TGxxxxxxxx	14 mm	
DFS60x-THxxxxxxxx	15 mm	
DFS60x-TJxxxxxxxx	5/8“	

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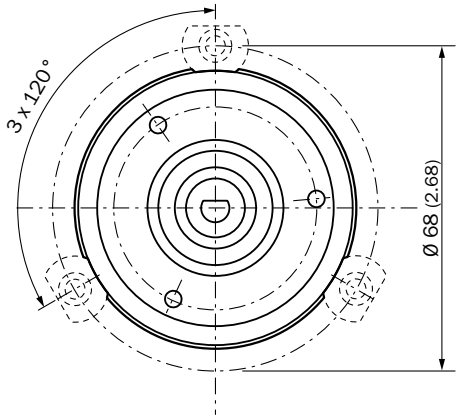
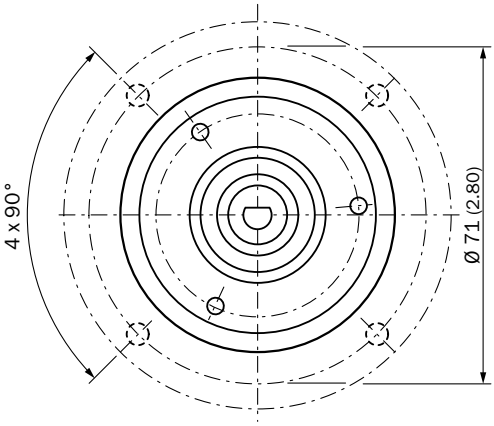
Proposed fitting

Mounting suggestion for small servo clamp (part number 2029166)



All dimensions in mm (inch)

Mounting suggestion for half-shell servo clamp (part number 2029165)

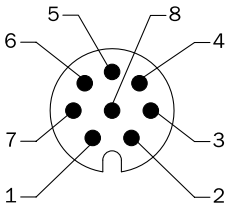


All dimensions in mm (inch)

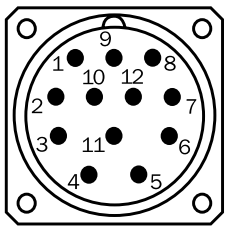
PIN assignment

Cable, 8-wire

View of M12 male device connector on encoder



View of M23 male device connector on encoder

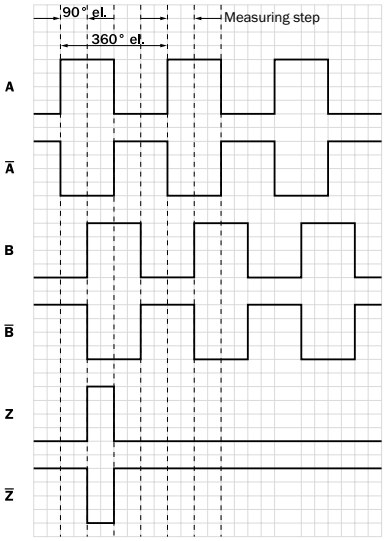


PIN, 8-pin, M12 male connector	PIN, 12-pin, M23 male connector	Color of the wires for encoders with cable outlet	TTL/HTL signal	Sin/cos 1.0 V_{ss}	Explanation
1	6	Brown	$\overline{A}$	COS–	Signal wire
2	5	White	A	COS+	Signal wire
3	1	Black	$\overline{B}$	SIN–	Signal wire
4	8	Pink	B	SIN+	Signal wire
5	4	Yellow	$\overline{Z}$	$\overline{Z}$	Signal wire
6	3	Violet	Z	Z	Signal wire
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.	Set zero pulse [1]
Screen	Screen	Screen	Screen	Screen	Screen connected to housing on encoder side. Connected to ground on control side.

[1] For electrical interfaces only: M, U, V, W with 0-SET function on PIN 7 on M23 male connector. The 0-SET input is used to set the zero pulse on the current shaft position. If the 0-SET input is connected to U_S for longer than 250 ms after it had previously been unassigned for at least 1,000 ms or had been connected to the GND, the current position of the shaft is assigned to the zero pulse signal "Z".

Interfaces

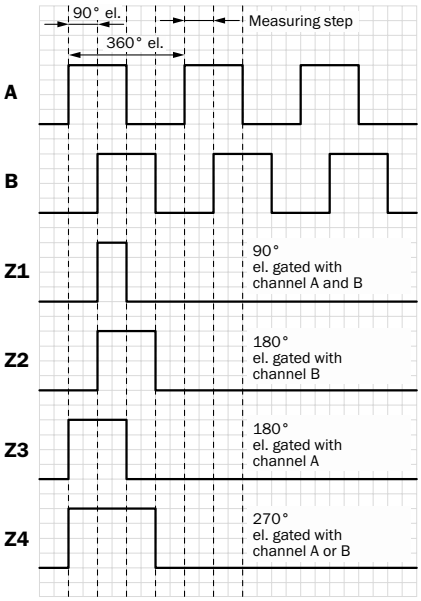
Signal outputs for electrical interfaces TTL and HTL



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

CW with view on the encoder shaft in direction “A”, compare dimensional drawing.

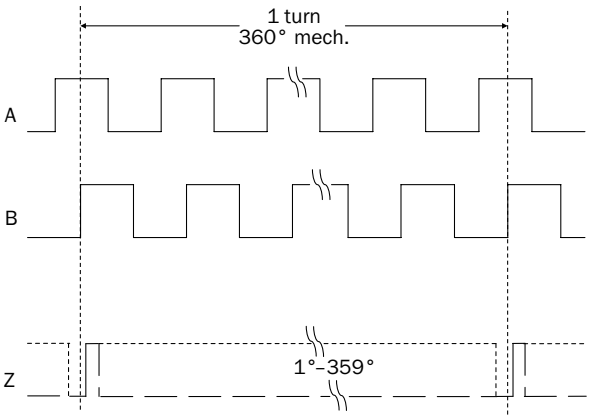
Electrical zero pulse width 90°, 180° or 270°, programmable Width of the zero pulse in relation to a pulse period.



CW with view on the encoder shaft in direction “A,” compare 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.



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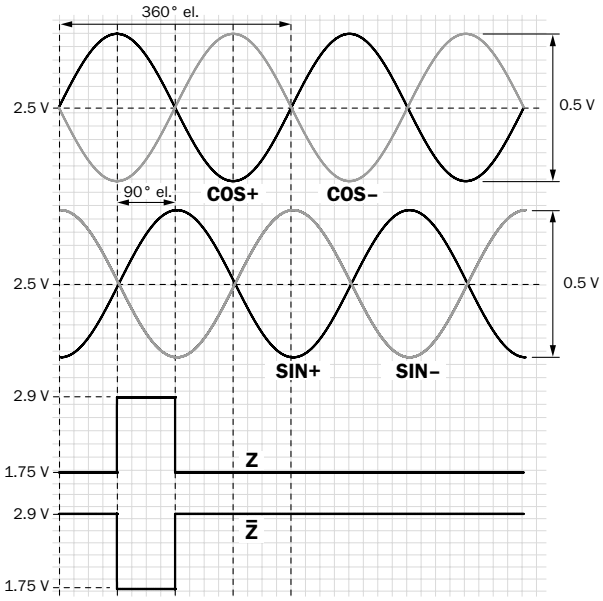
Electrical interfaces sin/cos 1.0 V_{SS}

Supply voltage	Output
4.5 ... 5.5 V	Sin/cos 1.0 V_{SS}

Signals **before** difference at 120 Ω load and U_S = 5 V

Signal diagram for clockwise shaft rotation, looking in direction "A" (shaft)



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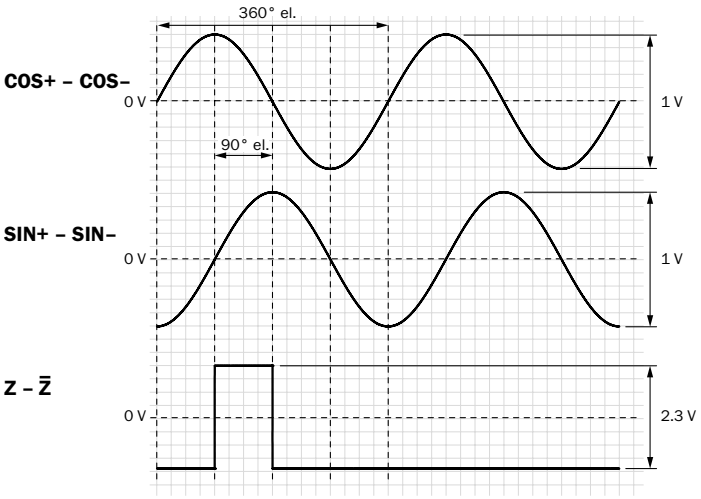
Interface signals Sin+, SIN–, COS+, COS–	Signals before difference at 120 Ω load	Signal offset
Differential analog	0.5 V_{SS} ± 20%	2.5 V ± 10%

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

Signals **after** difference at 120 Ω load and U_S = 5 V

Signal diagram for clockwise shaft rotation, looking in direction "A" (shaft)



Recommended accessories

Mounting systems

Mounting brackets and plates

Mounting bracket

Figure	Brief description	Type	Part no.
	Mounting bracket for encoder with centering hub 36 mm, including mounting kit for face mount flange	BEF-WF-36	2029164

Flanges

Flange plate

Figure	Brief description	Type	Part no.
	Standard two-sided stator coupling, with screw hole circle diameter 63 mm, slot width 3.2 mm, 10.4 mm high	BEF-DS00XFX	2056812
	One-sided stator coupling, slot, slot radius 33 mm – 48.5 mm, slot width 5.1 mm	BEF-DS01DFS/VFS	2047428
	One-sided stator coupling, slot, slot radius 32.25 mm – 141.75 mm, slot width 5.1 mm	BEF-DS02DFS/VFS	2047430
	One-sided stator coupling, slot, slot radius 33 mm – 211.9 mm, slot width 5.1 mm	BEF-DS03DFS/VFS	2047431
	Two-sided stator coupling, with screw hole circle diameter 72 mm, slot width 3.2 mm, 16.5 mm high	BEF-DS05XFX	2057423
	Two-sided stator coupling, with screw hole circle diameter 72 mm, slot width 3.2 mm, 10.4 mm high	BEF-DS07XFX	2059368
	Flange adapter, adaptation of face mount flange with 36 mm centering hub to 50 mm servo flange, aluminum, including 3 flat head screws M4 x 10	BEF-FA-036-050	2029160
	Flange adapter, adaptation of face mount flange with 36 mm centering hub to 60 mm square mounting plate, aluminum, including 3 flat head screws M4 x 10	BEF-FA-036-060REC	2029162
	Flange adapter, adaptation of face mount flange with 36 mm centering hub to 58 mm square mounting plate with shock absorbers, aluminum	BEF-FA-036-060RSA	2029163
	Flange adapter, adaptation of face mount flange with 36 mm centering hub to 63 mm square mounting plate, aluminum, including 3 flat head screws M4 x 10	BEF-FA-036-063REC	2034225
	Flange adapter, adaptation of face mount flange with 36 mm centering hub to 100 mm servo flange with 60 mm centering hub, aluminum	BEF-FA-036-100	2029161

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Other mounting accessories

Measuring wheels and measuring wheel systems

Figure	Brief description	Type	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
	Measuring wheel with smooth plastic surface (Hytrel) for 10 mm solid shaft, circumference 500 mm	BEF-MR-010050	5312989
	Measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 200 mm	BEF-MR006020R	2055222
	Measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 300 mm	BEF-MR006030R	2055634
	Measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 500 mm	BEF-MR006050R	2055225
	Measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 200 mm	BEF-MR010020R	2055224
	Measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 300 mm	BEF-MR010030R	2049278
	Measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 500 mm	BEF-MR010050R	2055227
	O-ring for measuring wheels (circumference 200 mm)	BEF-OR-053-040	2064061
	O-ring for measuring wheels (circumference 300 mm)	BEF-OR-083-050	2064076
	O-ring for measuring wheels (circumference 500 mm)	BEF-OR-145-050	2064074

Modular measuring wheel system

Brief description	Type	Part no.
Measuring wheel system, desired mounting position: left, for DBS60-S4, DFS60-S4, AFS60-S4, and AFM60-S4	BEF-MRS-10-1	2071958
Measuring wheel system, desired mounting position: right, for DBS60-S4, DFS60-S4, AFS60-S4, and AFM60-S4	BEF-MRS-10-2	2071957

Mounting bell

Figure	Brief description	Type	Part no.
	Mounting bell for encoders with a servo flange, centering hub 50 mm, including mounting kit	BEF-MG-50	5312987

Servo clamps

Figure	Brief description	Type	Part no.
	Half-shell servo clamps (2 pcs.) for servo flanges with a 50 mm centering hub	BEF-WG-SF050	2029165
	Servo clamps, large, for servo flanges (clamps, eccentric fastener), 3 pcs., without mounting material	BEF-WK-SF	2029166

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Subject to change without notice

Miscellaneous

Figure	Brief description	Type	Part no.
	Clamping ring for metal hollow shaft, metal	BEF-KR-M	2064709
	Bearing block for hollow shaft encoder, including fixing screws	BEF-FA-B12-010	2042728
	Bearing block for servo and face mount flange encoder	BEF-FA-LB1210	2044591
	Mounting kit for servo flange encoder on the bearing block, 1 bar coupling SKPS 1520 06/06 1 hexagon socket wrench SW1.5 DIN 911, 3 mounting eccentric BEMN 1242 49 3 screws M4 x 10 DIN 912,1 hexagon socket wrench SW3 DIN 911	BEF-MK-LB	5320872

Shaft adaptation

Collets and clamping rings

Figure	Brief description	Type	Part no.
	PEEK conductor insulation (shaft diameter 8 mm, outer diameter 10 mm)	PEEK CONDUCTOR INSULATION	2065642
	PEEK conductor insulation (shaft diameter 10 mm, outer diameter 12 mm)	PEEK CONDUCTOR INSULATION	2064571
	PEEK conductor insulation (shaft diameter 11 mm, outer diameter 12.7 mm)	PEEK CONDUCTOR INSULATION	2077319
	PEEK conductor insulation (shaft diameter 12 mm, outer diameter 14 mm)	PEEK CONDUCTOR INSULATION	2064573
	PEEK conductor insulation (shaft diameter 1/2"(12.7 mm), outer diameter 15 mm)	PEEK CONDUCTOR INSULATION	2064572
	Metal collet for hollow shaft, shaft diameter 8 mm, outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-008-M	2076219
	Metal collet for hollow shaft, shaft diameter 3/8 " (9.525 mm), outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-38Z-M	2076224
	Metal collet for hollow shaft, shaft diameter 10 mm, outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-010-M	2076220
	Metal collet for hollow shaft, shaft diameter 12 mm, outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-012-M	2076221
	Metal collet for hollow shaft, shaft diameter 1/2" (12.7 mm), outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-12Z-M	2076225
	Metal collet for hollow shaft, shaft diameter 14 mm, outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-014-M	2076222
	Metal collet for hollow shaft, shaft diameter 15 mm, outer diameter 5/8" (15.875 mm), metal	SPZ-58Z-015-M	2076223
	Plastic isolated collet for hollow shaft, shaft diameter 6 mm, outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-006-P	2076228
	Plastic isolated collet for hollow shaft, shaft diameter 8 mm, outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-008-P	2076229
	Plastic isolated collet for hollow shaft, shaft diameter 3/8" (9.525 mm), outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-38Z-P	2076226
	Plastic isolated collet for hollow shaft, shaft diameter 10 mm, outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-010-P	2076230
	Plastic isolated collet for hollow shaft, shaft diameter 12 mm, outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-012-P	2076231
	Plastic isolated collet for hollow shaft, shaft diameter 1/2" (12.7 mm), outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-12Z-P	2076227
	Plastic isolated collet for hollow shaft, shaft diameter 14 mm, outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-014-P	2076232
	Plastic isolated collet for hollow shaft, shaft diameter 15 mm, outer diameter 5/8" (15.875 mm), plastic	SPZ-58Z-015-P	2076233

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Shaft couplings

Figure	Brief description	Type	Part no.
	Bellows coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular +/- 4°; max. speed 10,000 rpm, –30 °C to +120 °C, max. torque 80 Ncm; material: stainless steel bellows, aluminum hub	KUP-0606-B	5312981
	Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular +/- 4°; max. speed 10,000 rpm, –30 °C to +120 °C, max. torque 80 Ncm; material: stainless steel bellows, aluminum hub	KUP-0610-B	5312982
	Bellows coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular +/- 4°; max. speed 10,000 rpm, –30 °C to +120 °C, max. torque 80 Ncm; material: stainless steel bellows, aluminum hub	KUP-1010-B	5312983
	Bellows coupling, shaft diameter 10 mm/12 mm; maximum shaft offset: radial +/- 0.25 mm, axial +/- 0.4 mm, angular +/- 4°; max. revolutions 10,000 rpm, –30 ° to +120 °C, max. torque 80 Ncm; material: stainless steel bellows, aluminum clamping hubs	KUP-1012-B	5312984
	Bar coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angle ± 3°; max. speed 10,000 rpm, –10 °C to +80 °C, max. torque 80 Ncm; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0606-S	2056406
	Bar coupling, shaft diameter 6 mm / 8 mm, maximum shaft offset radial ± 0.3 mm, axial ± 0.2 mm, angle ± 3°; max. speed 10,000 rpm, torsion spring rigidity 38 Nm/wheel; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0608-S	5314179
	Bar coupling, shaft diameter 6 mm/10 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angular ± 3°; max. speed 10,000 rpm, –10 °C to +80 °C, max. torque 80 Ncm; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0610-S	2056407
	Bar coupling, shaft diameter 8 mm / 10 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angular ± 3°; torsion spring rigidity 38 Nm/wheel; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0810-S	5314178
	Bar coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset radial ± 0.3 mm, axial ± 0.2 mm, angle ± 3°; max. speed 10,000 rpm, torsion spring rigidity 38 Nm/wheel; material: fiber-glass reinforced polyamide, aluminum hub	KUP-1010-S	2056408
	Spring washer coupling, shaft diameter 6 mm/10 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.4 mm, angular ± 2.5°; max. speed 12,000 rpm, –10 °C to +80 °C, max. torque 60 Ncm; material: aluminum flange, fiber-glass reinforced polyamide membrane and tempered steel coupling pin	KUP-0610-F	5312985
	Spring washer coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.4 mm, angular ± 2.5°; max. speed 12,000 rpm, –10° to +80° Celsius, max. torque 60 Ncm; material: aluminum flange, glass fiber-reinforced polyamide membrane and hardened steel coupling pin	KUP-1010-F	5312986
	Double-loop coupling, shaft diameter 6 mm/10 mm, maximum shaft offset: radial ± 2.5 mm, axial ± 3 mm, angular ± 10°; max. speed 3,000 rpm, –30 °C to +80 °C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange	KUP-0610-D	5326697
	Double-loop coupling, shaft diameter 8 mm/10 mm, maximum shaft offset: radial ± 2.5 mm, axial ± 3 mm, angular ± 10°; max. speed 3,000 rpm, –30 °C to +80 °C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange	KUP-0810-D	5326704
	Double-loop coupling, shaft diameter 10 mm/10 mm, maximum shaft offset: radial ± 2.5 mm, axial ± 3 mm, angular ± 10°; max. speed 3,000 rpm, –30 °C to +80 °C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange	KUP-1010-D	5326703
	Double-loop coupling, shaft diameter 10 mm/12 mm, maximum shaft offset: radial ± 2.5 mm, axial ± 3 mm, angular ± 10°; max. speed 3,000 rpm, –30 °C to +80 °C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange	KUP-1012-D	5326702

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Connectivity

Plug connectors and cables

Connecting cables with female connector

Figure	Brief description	Length of cable	Type	Part no.
	Head A: female connector, JST, 8-pin, straight Head B: cable Cable: incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.15 mm², Ø 5.6 mm	0.5 m	DOL-0J08-G0M5AA3	2046873
		1.5 m	DOL-0J08-G1M5AA3	2046874
		3 m	DOL-0J08-G03MAA3	2046875
		5 m	DOL-0J08-G05MAA3	2046876
		10 m	DOL-0J08-G10MAA3	2046877
	Head A: female connector, M12, 8-pin, straight Head B: cable Cable: suitable for drag chain, PVC, shielded, 4 x 2 x 0.25 mm², Ø 7.0 mm	2 m	DOL-1208-G02MAC1	6032866
		5 m	DOL-1208-G05MAC1	6032867
		10 m	DOL-1208-G10MAC1	6032868
		20 m	DOL-1208-G20MAC1	6032869
	Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm [1]	2 m	DOL-2312-G02MLA3	2030682
		7 m	DOL-2312-G07MLA3	2030685
		10 m	DOL-2312-G10MLA3	2030688
		15 m	DOL-2312-G15MLA3	2030692
		20 m	DOL-2312-G20MLA3	2030695
		25 m	DOL-2312-G25MLA3	2030699
		30 m	DOL-2312-G30MLA3	2030702
	Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, suitable for drag chain, PUR, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm [1]	1.5 m	DOL-2312-G1M5MA3	2029212
		3 m	DOL-2312-G03MMA3	2029213
		5 m	DOL-2312-G05MMA3	2029214
		10 m	DOL-2312-G10MMA3	2029215
		20 m	DOL-2312-G20MMA3	2029216
		30 m	DOL-2312-G30MMA3	2029217
	Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm [2]	2 m	DOL-2312-G02MLD1	2062202
		7 m	DOL-2312-G07MLD1	2062203
		10 m	DOL-2312-G10MLD1	2062204
		15 m	DOL-2312-G15MLD1	2062205
		20 m	DOL-2312-G20MLD1	2062206
		25 m	DOL-2312-G25MLD1	2062207
		30 m	DOL-2312-G30MLD1	2062208
	Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, suitable for drag chain, PUR, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm [2]	1.5 m	DOL-2312-G1M5MD1	2062240
		3 m	DOL-2312-G03MMD1	2062243
		5 m	DOL-2312-G05MMD1	2062244
		10 m	DOL-2312-G10MMD1	2062245
		20 m	DOL-2312-G20MMD1	2062246
		30 m	DOL-2312-G30MMD1	2062247

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

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

F

Female connector (ready to assemble)

Figure	Brief description	Type	Part no.
	Head A: female connector, M12, 8-pin, straight, A encoded, shielded, for cable diameter 4 mm ... 8 mm Head B: - Operating temperature: –40 °C ... +85 °C	DOS-1208-GA01	6045001
	Head A: female connector, M23, 12-pin, straight, shielded, for cable diameter 5.5 mm ... 10.5 mm Head B: - Operating temperature: –20 °C ... +130 °C	DOS-2312-G	6027538
	Head A: female connector, M23, 12-pin, angled, shielded, for cable diameter 4.2 mm ... 6.6 mm Head B: - Operating temperature: –20 °C ... +130 °C	DOS-2312-W01	2072580
	Head A: female connector, M23, 12-pin, straight, shielded, for cable diameter 5.5 mm ... 10.5 mm Head B: - Operating temperature: –40 °C ... +125 °C	DOS-2312-G02	2077057

Cables (ready to assemble)

Figure	Brief description	Length of cable	Type	Part no.
	Head A: cable Head B: cable Cable: suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.15 mm², Ø 5.6 mm	By the meter	LTG-2308-MWENC	6027529
	Head A: cable Head B: cable Cable: PUR, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.5 mm		LTG-2411-MW	6027530
	Head A: cable Head B: cable Cable: suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 2 x 0.14 mm², Ø 7.8 mm		LTG-2512-MW	6027531
	Head A: cable Head B: cable Cable: suitable for drag chain, PUR, halogen-free, shielded, UV and saltwater resistant, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 2 x 0.14 mm², Ø 7.8 mm		LTG-2612-MW	6028516

Male connector (ready to assemble)

Figure	Brief description	Type	Part no.
	Head A: male connector, M12, 8-pin, straight, A encoded, shielded, for cable diameter 4 mm ... 8 mm Head B: - Operating temperature: –40 °C ... +85 °C	STE-1208-GA01	6044892
	Head A: male connector, M23, 12-pin, straight, shielded, for cable diameter 5.5 mm ... 10.5 mm Head B: Operating temperature: –20 °C ... +130 °C	STE-2312-G	6027537
	Head A: male connector, M23, 12-pin, straight, for cable diameter 5.5 mm ... 10.5 mm Head B: - Operating temperature: –40 °C ... +125 °C	STE-2312-G01	2077273

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8015560/2015-09-01
Subject to change without notice

Connection cables with female and male connector

Figure	Brief description	Length of cable	Type	Part no.
	Head A: female connector, JST, 8-pin, straight Head B: male connector, M23, 12-pin, straight Cable: suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.15 mm², Ø 5.6 mm	0.35 m	STL-2312-GM35AA3	2061621
		1 m	STL-2312-G01MAA3	2061622
		2 m	STL-2312-G02MAA3	2061504
	Head A: female connector, connector system, 8-pin, straight Head B: male connector, D-Sub, 9-pin, straight Cable: PVC, shielded, can be used for encoders with cable outlet in conjunction with PGT-10-Pro	0.5 m	DSL-0D08-G0M5AC3	2061739
	Head A: female connector, M12, 8-pin, straight Head B: male connector, D-Sub, 9-pin, straight Cable: shielded, 4 x 2 x 0.08 mm²	0.5 m	DSL-2D08-G0M5AC3	2046579
	Head A: female connector, M23, 12-pin, straight Head B: male connector, D-Sub, 9-pin, straight Cable: shielded, 4 x 2 x 0.08 mm²	0.5 m	DSL-3D08-G0M5AC3	2046580

Other accessories

Programming and configuration tools

Figure	Brief description	Type	Part no.
	Programming unit USB, for programmable SICK Encoders AFS60, AFM60, DFS60, VFS60, DFV60 and wire draw encoders with programmable encoder.	PGT-08-S	1036616
	Programming unit display for programmable SICK DFS60, VFS60, DFV60, AFS/AFM60, AHS/AHM36 encoders, and wire draw encoders with DFS60, AFS/AFM60, and AHS/AHM36. Compact dimensions, low weight, and intuitive operation.	PGT-10-Pro	1072254

→ For additional accessories, please see page K-668 onwards

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