PRODUCT INFORMATION

VFS60
Motor Feedback System Rotary Incremental

Robust, versatile and perfected for asynchronous motors

SICK
Sensor Intelligence.

Robust, versatile and perfected for asynchronous motors

Additional information

Product description

Motor feedback systems from the VFS60 product family are ideally suited for use in industrial applications under rough conditions, especially for attaching to asynchronous motors. A large number of product variants meets almost all requirements: with through hollow shaft or blind hollow shaft of 8 mm to 15 mm diameter, with plug-in cable outlet or pre-assembled connector at the cable end. This means more mechanical flexibility. In addition, the robust shaft bearing increases the service life while at the same time reducing the servicing and maintenance requirements. The increased bearing distance guarantees a previously unattainable low level of vibration and optimum concentricity, even at maximum operating speed.

The product families are allocated to different performance classes. From different defined line counts to a pre-programmed version. Moreover, all the common electrical interfaces are available. TTL, HTL or sine 0.5 V_{pp}.

At a glance

- TTL, HTL or sine 0.5 V_{pp} interfaces
- Resolution of up to 65,536 lines per revolution
- Individual programming of the interface, line count and of the zero pulse
- Direct programming via RS485
- Excellent concentricity through large distance between the ball bearings
- Exceptional robustness
- Protection class IP 65
- Mechanical flexibility through blind hollow shaft and through hollow shafts with diameters of 8 to 15 mm, available with various torque supports
- Temperature range from –30 °C to +100 °C
- Insulated shaft connection through plastic collar possible

Your benefits

- Programmable version for a reduced product variety
- Various programming tools designed to take into account your own programming requirements
- High performance and reliability even in rough ambient conditions
- High vibration resistance and extended temperature range through nickel code disk
- Large ball bearing distances reduce uneven wear and minimize vibration on the motor feedback housing, which increases the motor feedback system's service life
- The "Insulated shaft connection" prevents electrical continuity through the bearings of the motor feedback system thus extending the operating life of the system

Detailed technical data

Performance

Type	E	B	A
Number of lines per revolution [1]	1000, 1024, 2000, 2048	1000, 1024, 2000, 2048, 4096, 8192, 16384, 32768, 65536	1 ... 8192, 16384, 32768, 65536
Sine 0.5 V_{pp}	1024	–	–
Measuring step	90° electrical / number of lines		
Reference signal			
Number	1		
Position	90° electr., logic operation with A and B / sine and cosine		
Error limits	± 0.3°	± 0.05°	± 0.03°
Measuring step deviation			
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 5.

Mechanical data

Shaft diameter		
Blind hollow shaft, through hollow shaft	8, 10, 12, 14, 15 mm and 3/8", 1/2", 5/8"	
Material		
Material shaft	Stainless steel	
Material flange	Zinc diecasting	
Material housing	Aluminium diecasting	
Mass		
Blind hollow shaft, through hollow shaft	0.2 kg	
Start-up torque at 20 °C		
Blind hollow shaft, through hollow shaft	0.8 Ncm	
Operating torque at 20 °C		
Blind hollow shaft, through hollow shaft	0.6 Ncm	
Angular acceleration	5×10^5 rad/s²	
Permissible shaft movement of the drive element static/dynamic		
Blind hollow shaft, through hollow shaft	± 0.3/± 0.1 mm radial ± 0.5/± 0.2 mm axial	± 0.3/± 0.05 mm radial ± 0.5/± 0.1 mm axial
Operating speed max. [1]		
Blind hollow shaft	6,000 min^{-1}	
Through hollow shaft	9,000 min^{-1}	
Moment of inertia of the rotor		
Blind hollow shaft, through hollow shaft	40 gcm²	
Bearing lifetime	3×10^9 revolutions	

[1] Internal heating 3.3 K/1,000 min^{-1}, when applying note working temperature.

Electrical data

Type	E	B	A
Max. output frequency			
TTL/RS422	300 kHz	600 kHz	820 kHz
HTL/push pull	300 kHz	600 kHz	820 kHz
Sine 0.5 V_{pp}	200 kHz	–	–
TTL/HTL programmable	–	–	820 kHz
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 ... 32 V, TTL/HTL programmable	–		30 mA
Load resistance			
4.5 ... 5.5 sine 0.5 V_{pp}	Min. 120 Ω	–	–
Operating current with no load			
4.5 ... 5.5 V, TTL/RS422	40 mA		
4.5 ... 5.5 V, sine 0,5 V	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 ... 32 V, TTL/HTL programmable	–	–	0.7 W
Reverse polarity protection			
4.5 ... 5.5 V, TTL/RS422	–		
10 ... 32 V, TTL/RS422	Yes		
10 ... 32 V, HTL/push pull	Yes		
4.5 ... 5.5 V, sine 0.5 V_{pp}	–		
4.5 ... 32 V, TTL/HTL programmable	Yes		
Short-circuit protection of the outputs			
4.5 ... 5.5 V, TTL/RS422	Yes [1]		
10 ... 32 V, TTL/RS422	Yes [2]		
10 ... 32 V, HTL/push pull	Yes [1]		
4.5 ... 5.5 V, sine 0.5 V_{pp}	Yes [1]		
4.5 ... 32 V, TTL/HTL programmable	–	–	Yes, HTL [1] and TTL [2]

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

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

Interfaces

Type	E	B	A
Electrical interfaces			
	4.5 ... 5.5 V, TTL/RS422		
	10 ... 32 V, TTL/RS422		
	10 ... 32 V, HTL/push pull		
	4.5 ... 5.5 sine 0.5 V_{pp}	–	–
	–		4.5 ... 32 V, TTL/HTL programmable [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, sine 0.5 V_{PP}	40 ms		
4.5 ... 32 V, TTL/HTL programmable	–	–	Max. 30 ms/max. 32 ms with mechanical zero pulse width

[1] Factory settings: Output level TTL.

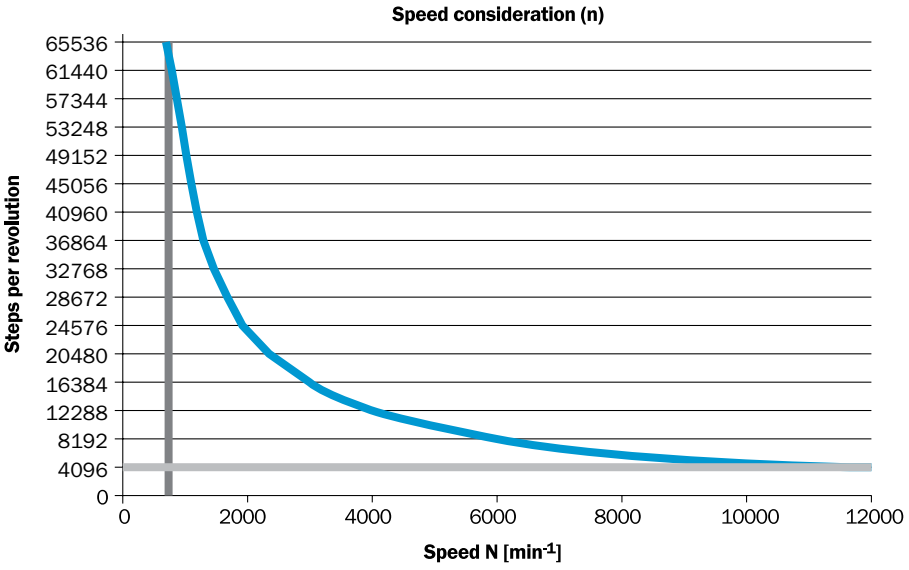
Ambient data

EMC [1]	As per EN 61000-6-2 and EN 61000-6-3
Enclosure rating as per IEC 60529	
On the shaft	IP 65
On the housing, cable outlet	IP 67
Permissible relative air humidity [2]	90 %
Working temperature range	–30 ... +100 °C
Storage temperature range (without packaging)	–40 ... +100 °C
Resistance	
To shocks as per EN 60068-2-27	70 g/6 ms
To vibration as per EN 60068-2-6	30 g/10 ... 2,000 Hz

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

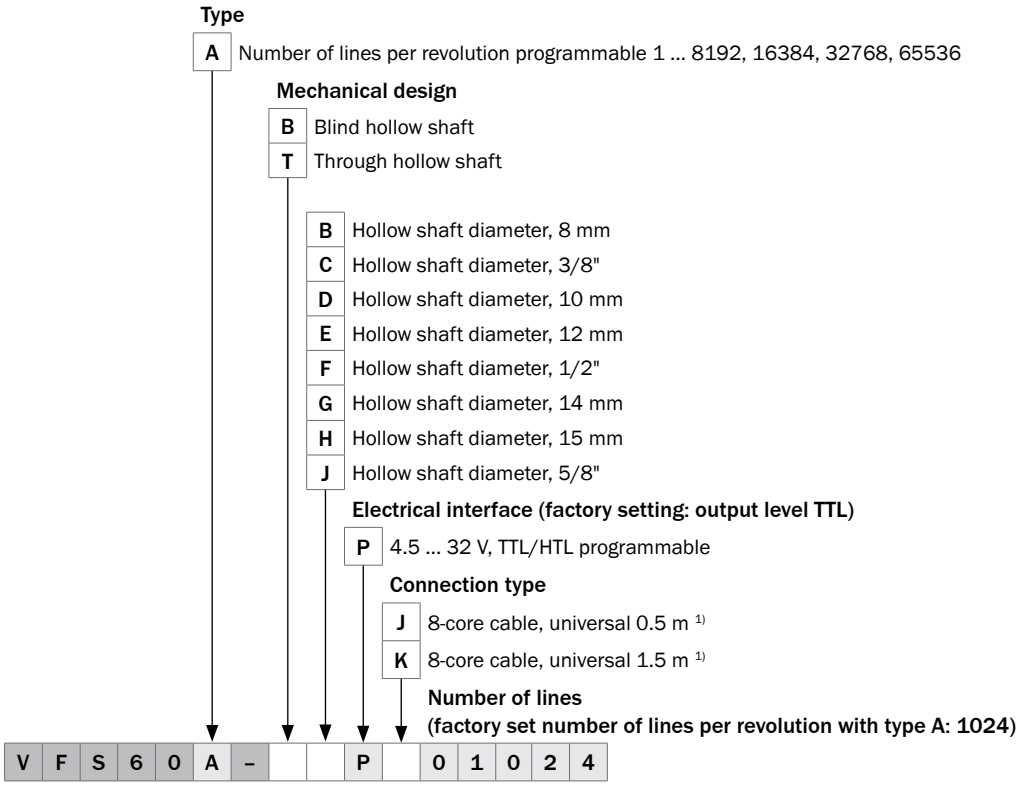
[2] Condensation on the optical scanner not permissible.

Maximum revolution range



Ordering information

Type code blind hollow shaft and through hollow shaft, **programmable**

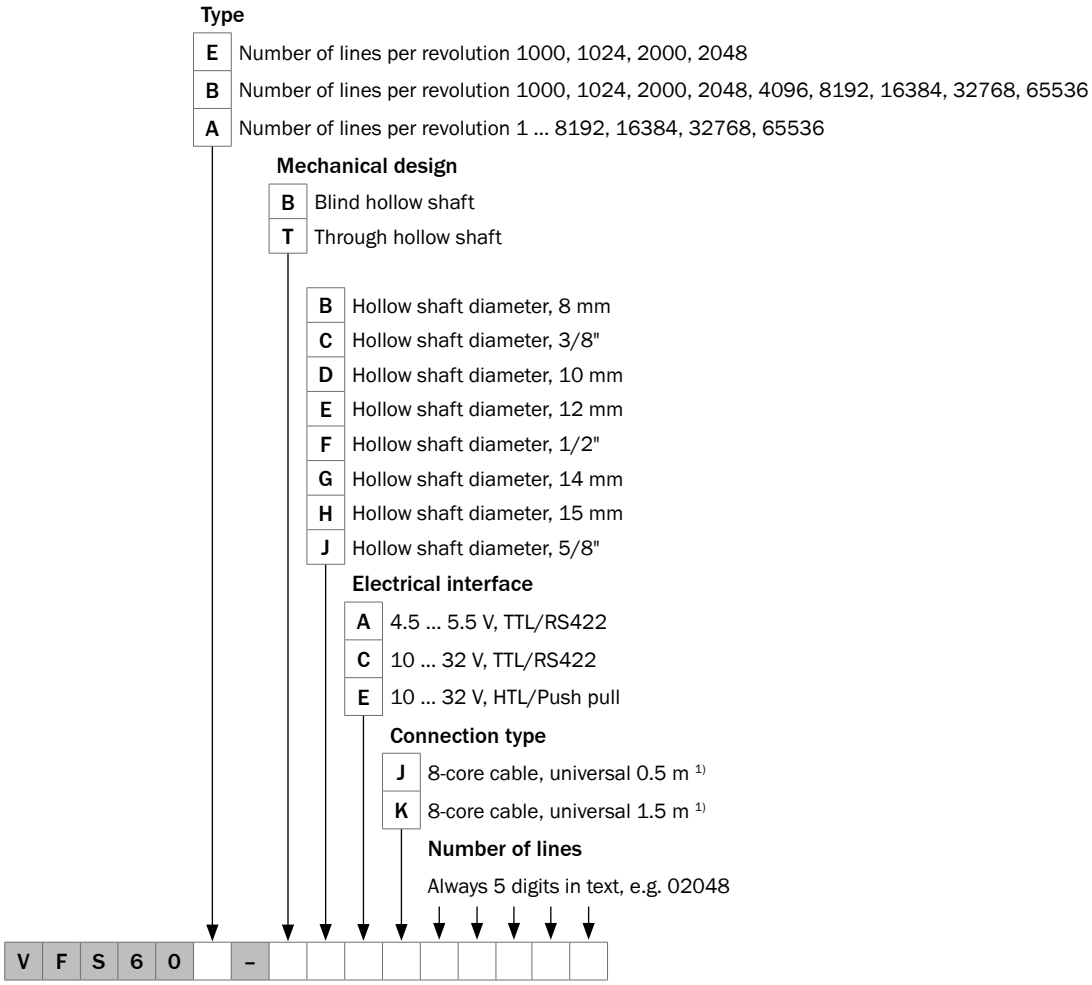


1) The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

The following features can be programmed:

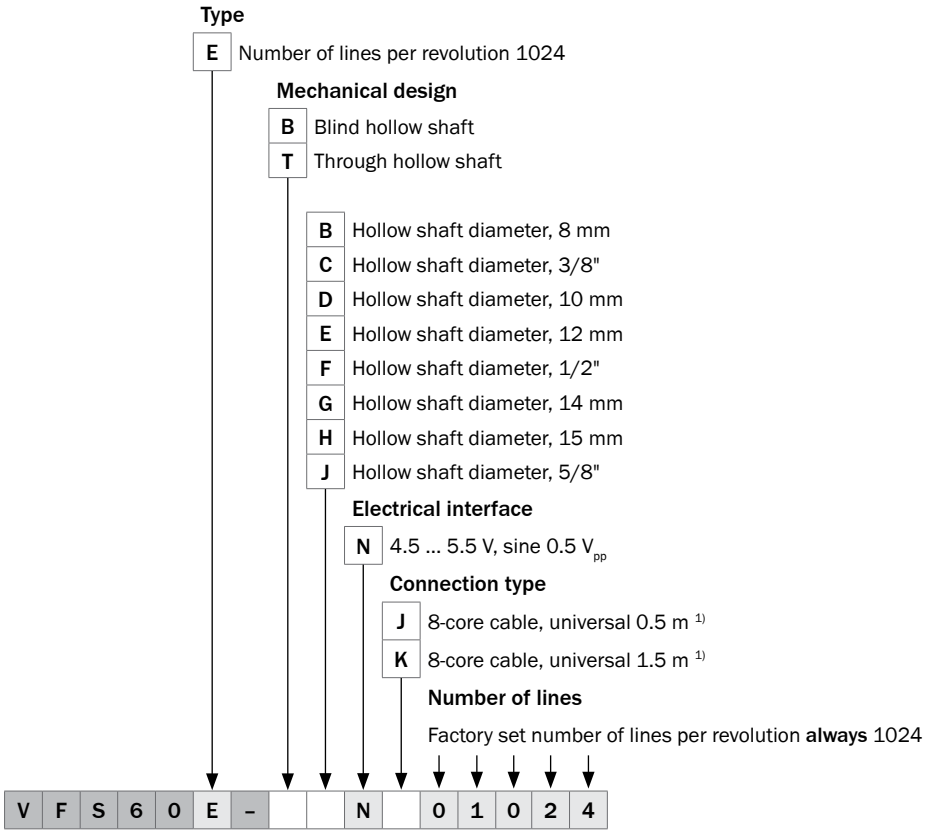
- Number of lines per revolution from 1 ... 65536 using programming tools PGT-08-S or PGT-10-S (see accessories on page 13).
- Zero pulse width electrically 90°, 180°, 270° using programming tools PGT-08-S or PGT-10-S (see accessories on page 13).
- Level of the output voltage TTL/HTL using programming tools PGT-08-S or PGT-10-S (see accessories on page 13).
- Zero SET function using programming tools PGT-08-S or PGT-10-S (see accessories on page 13).

Type code blind hollow shaft and through hollow shaft, **not programmable**



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

Type code blind hollow shaft and through hollow shaft, sine 0.5 V_{pp} interface

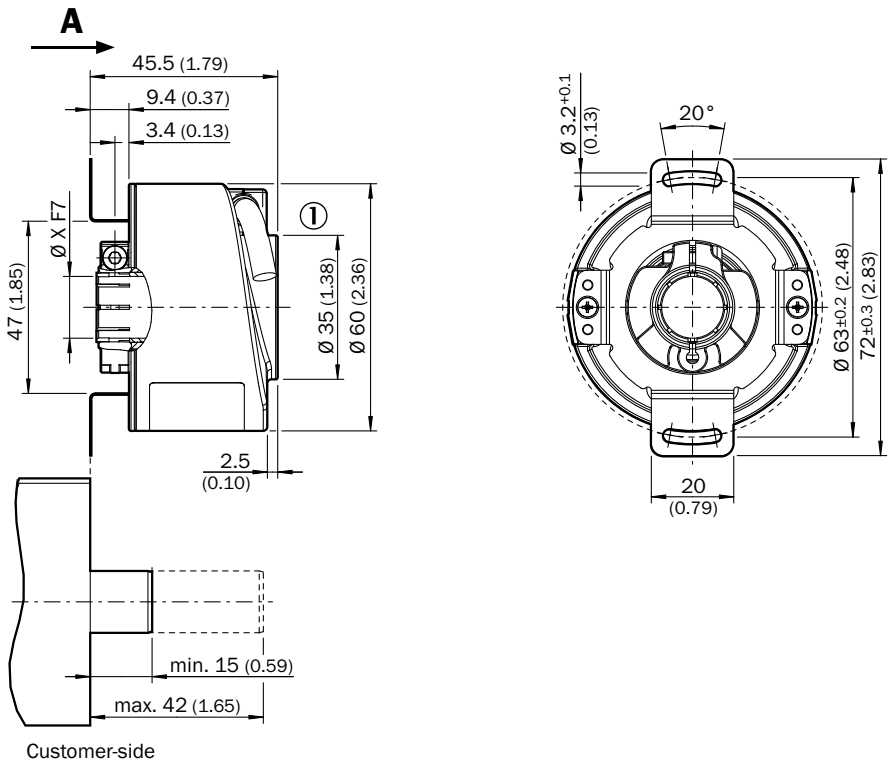


1) The universal cable outlet is positioned in such a way that kink-free laying in radial or axial direction is possible.

Dimensional drawings

dimensions in mm (inch)

Blind hollow shaft, cable outlet

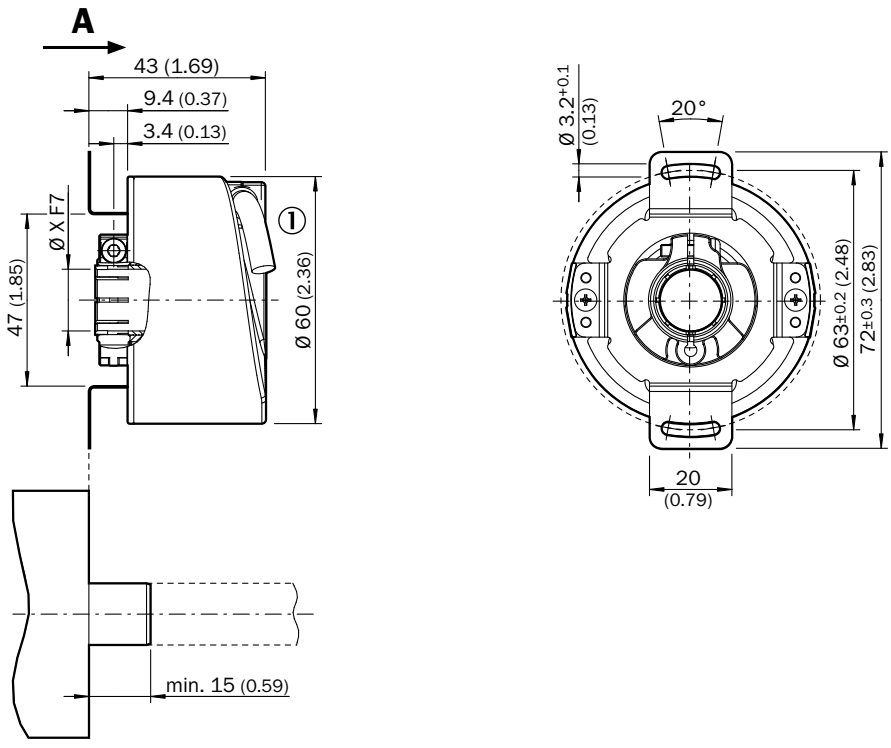


Customer-side

General tolerances as per DIN ISO 2768-mk.

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

Through hollow shaft, cable outlet



Customer-side

General tolerances as per DIN ISO 2768-mk.

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

Core assignment

Color wires	Signal TTL, HTL	Signal sine 0.5 V_{pp}	Explanation
Brown	$\overline{A}$	COS–	Signal cable
White	A	COS+	Signal cable
Black	$\overline{B}$	SIN–	Signal cable
Pink	B	SIN+	Signal cable
Yellow	$\overline{Z}$	$\overline{Z}$	Signal cable
Lilac	Z	Z	Signal cable
Blue	GND	GND	Ground connection of the encoder
Red	$+U_S$	$+U_S$	Supply voltage [1]
Shield	Shield	Shield	Shield connected to housing on side of encoder. Connected to ground on side of control.

[1] Volt-free to housing.

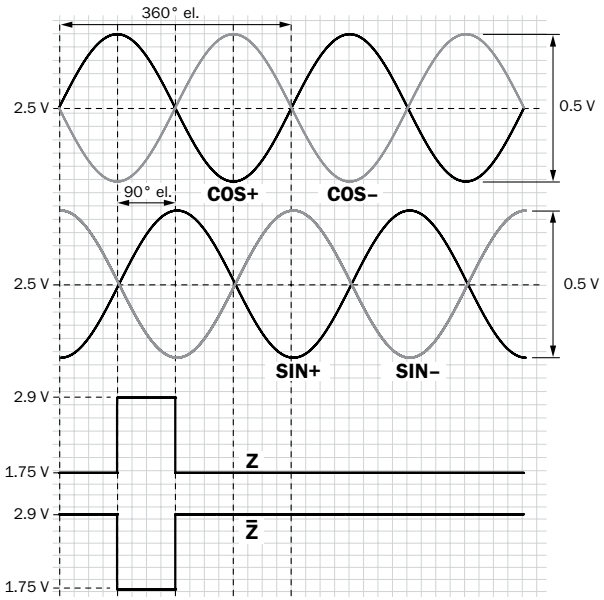
Interfaces

Electrical interfaces sine 0.5 V_{pp}

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

Signal **before** differential generation at load 120 Ω and U_S = 5 V

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

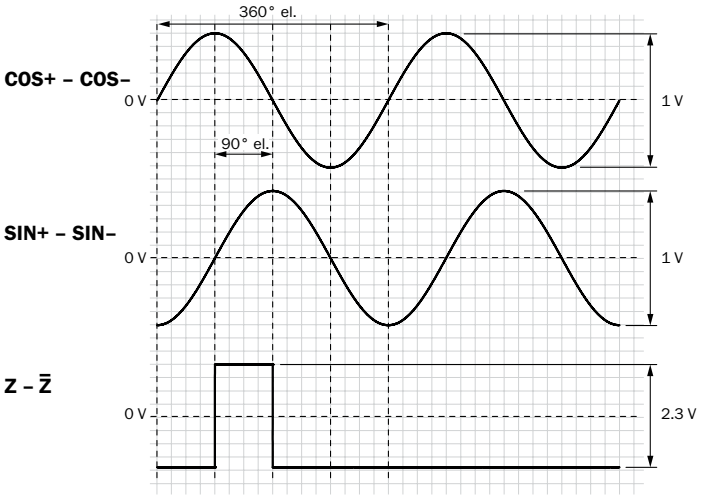


Interface signals Sin+, SIN–, COS+, COS–	Signal before differential generation at load 120 Ω	Signal offset
Analog differential	0.5 V_{pp} ± 20 %	2.5 V ± 10 %

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

Signal **after** differential generation at load 120 Ω and U_S = 5 V

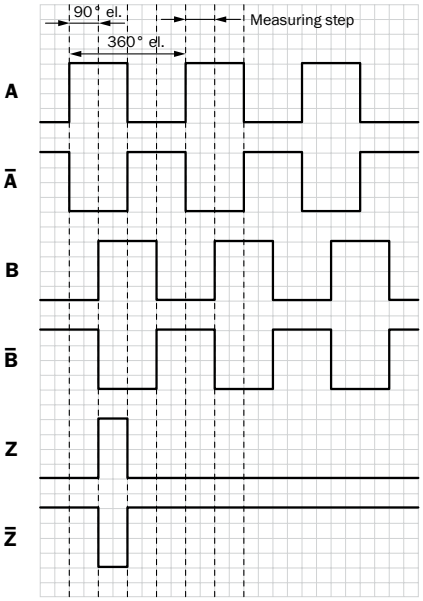
Signal diagram for clockwise rotation of the shaft looking in direction "A" (shaft)



Electrical interfaces TTL/HTL

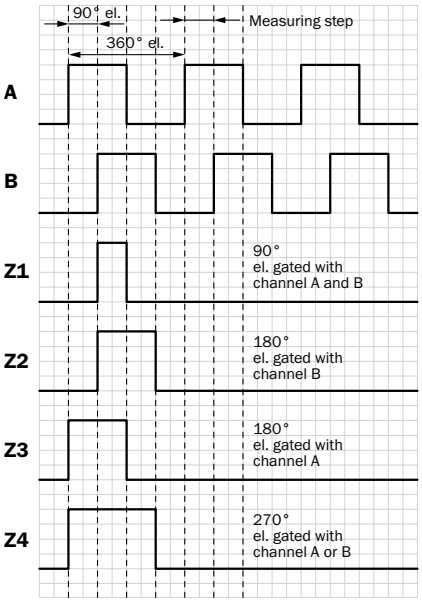
Power supply	Output
4.5 ... 5.5 V	TTL/RS422
10 ... 32 V	TTL/RS422
	HTL/Push-pull
4.5 ... 32 V	HTL/TTL programmable

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.

Accessories

dimensions in mm (inch)

Programming tools

	Description	Model name	Part no.
	Programming tool for VFS60 (connection to commercially available PCs or notebooks)	PGT-08-S	1036616
	Programming tool stand alone for VFS60	PGT-10-S	1052967

Adapter cable for programming tools

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

	Description	Model name	Part no.
	PGT-10-S adapter cable with SUB-D 9-pin cable connector, shielded, cable length of 0.5 m for VFS60 with cable outlet	DSL-0D08-G0M5AC3	2061739

Plug connectors and cables

Cables

- With shield

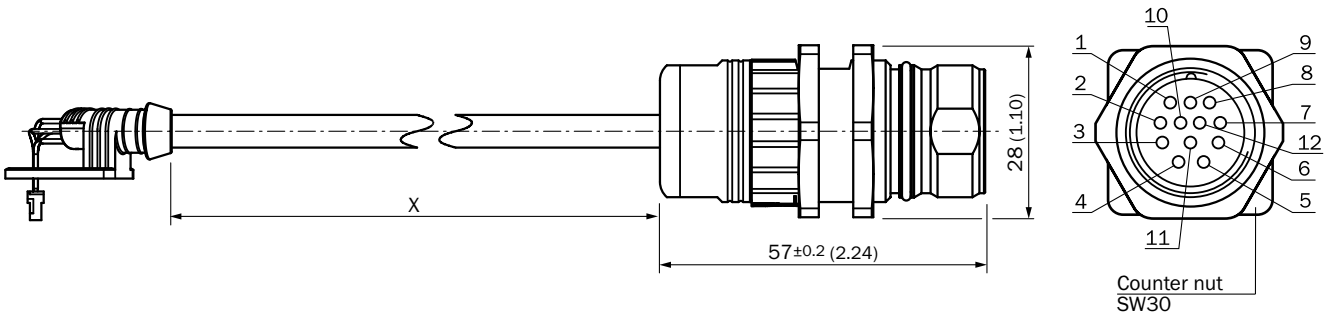
Cores	Cable diameter	Description	Cable length	Model name	Part no.
8	5.6 mm	Cable of 4 x 2 x 0.15 mm², carrier-capable	Bulk goods	LTG-2308-MWENC	6027529
		Cable incl. gasket, 4 x 2 x 0.15 mm² for VFS60 with cable outlet	0.5 m	DOL-0J08-G0M5AA3	2046873
			1.5 m	DOL-0J08-G1M5AA3	2046874
			3.0 m	DOL-0J08-G03MAA3	2046875
			5.0 m	DOL-0J08-G05MAA3	2046876
			10.0 m	DOL-0J08-G10MAA3	2046877
11	7.5 mm	Cable 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 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm², carrier-capable	Bulk goods	LTG-2512-MW	6027531
		Cable 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

Round screw system M23

- Straight, shielded

Description	Cable length	Model name	Part no.
Cable connector M23, 12-pin straight, cable 8-wire incl. gasket, 4 x 2 x 0.15 mm² screened, cable diameter 5.6 mm	0.35 m	STL-2312-GM35AA3	2061621
	1.0 m	STL-2312-G01MAA3	2061622
	2.0 m	STL-2312-G02MAA3	2061504

STL-2312-GM35AA3
STL-2312-G01MAA3
STL-2312-G02MAA3



PIN allocation connector M23

PIN	Signal TTL, HTL	Signal sine 0.5 V_{pp}
1	$\overline{B}$	SIN–
2	Not connected	Not connected
3	Z	Z
4	$\overline{Z}$	$\overline{Z}$
5	A	COS+
6	$\overline{A}$	COS–
7	Not connected	Not connected
8	B	SIN+
9	Not connected	Not connected
10	GND	GND
11	Not connected	Not connected
12	U_S	U_S
Shield	Shield [1]	Shield [1]

Attention!

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

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

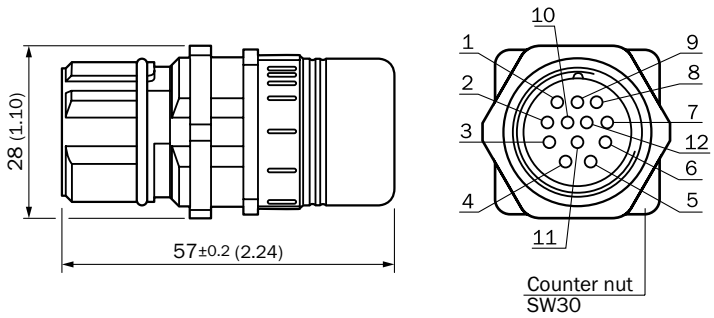
[1] Shield connected to housing on side of encoder. Connected to ground on side of control.

Round screw system M23

- Straight, shielded

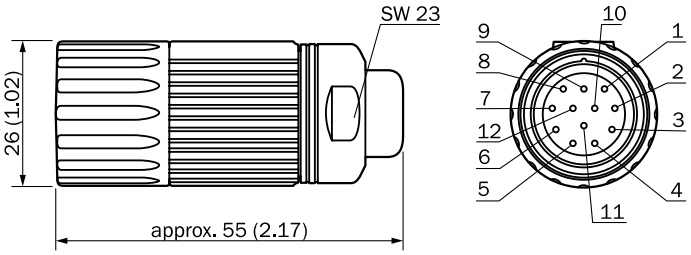
Contacts	Description	Model name	Part no.
12	Cable connector	STE-2312-GX	6028548
	Cable socket	DOS-2312-G	6027538

STE-2312-GX



General tolerances as per DIN ISO 2768-mk

DOS-2312-G



General tolerances as per DIN ISO 2768-mk

Description	Cable length	Model name	Part no.
Cable socket, 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	Model name	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

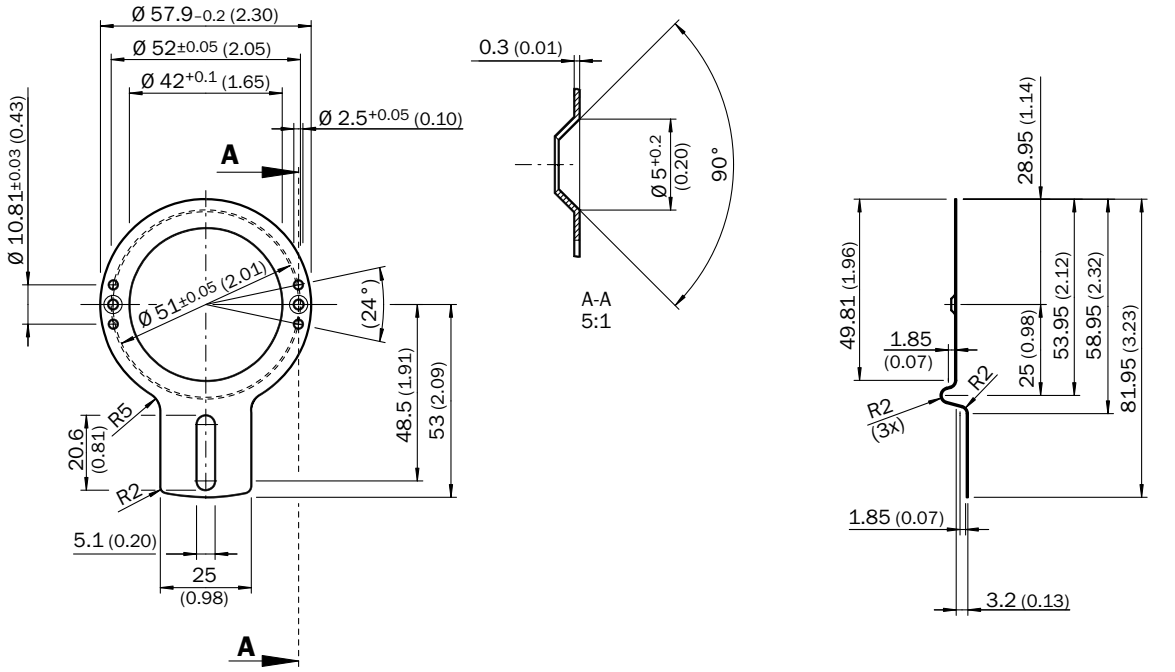
Insulating shaft connection

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

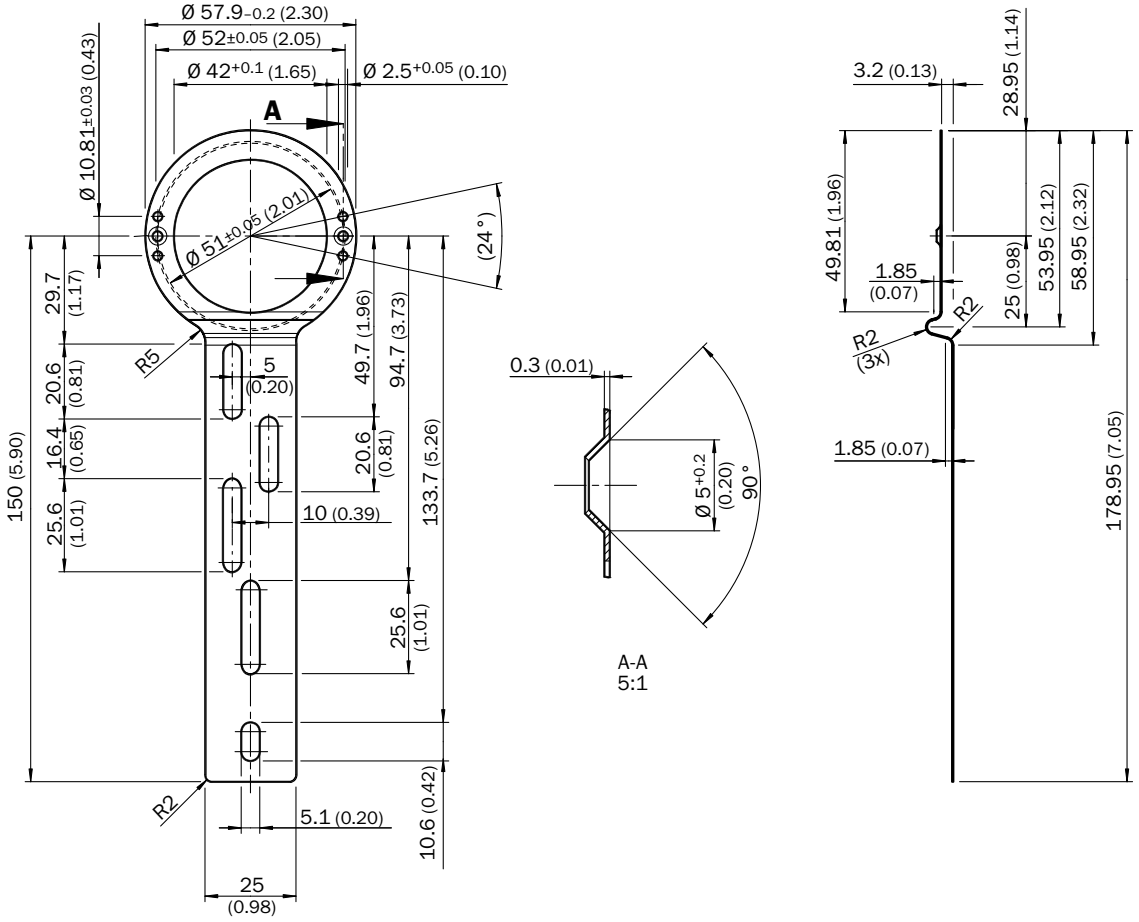
Further mounting versions

Description	Model name	Part no.
Version 1	BEF-DS01DFS/VFS	2047428
Version 2	BEF-DS02DFS/VFS	2047430
Version 3	BEF-DS03DFS/VFS	2047431

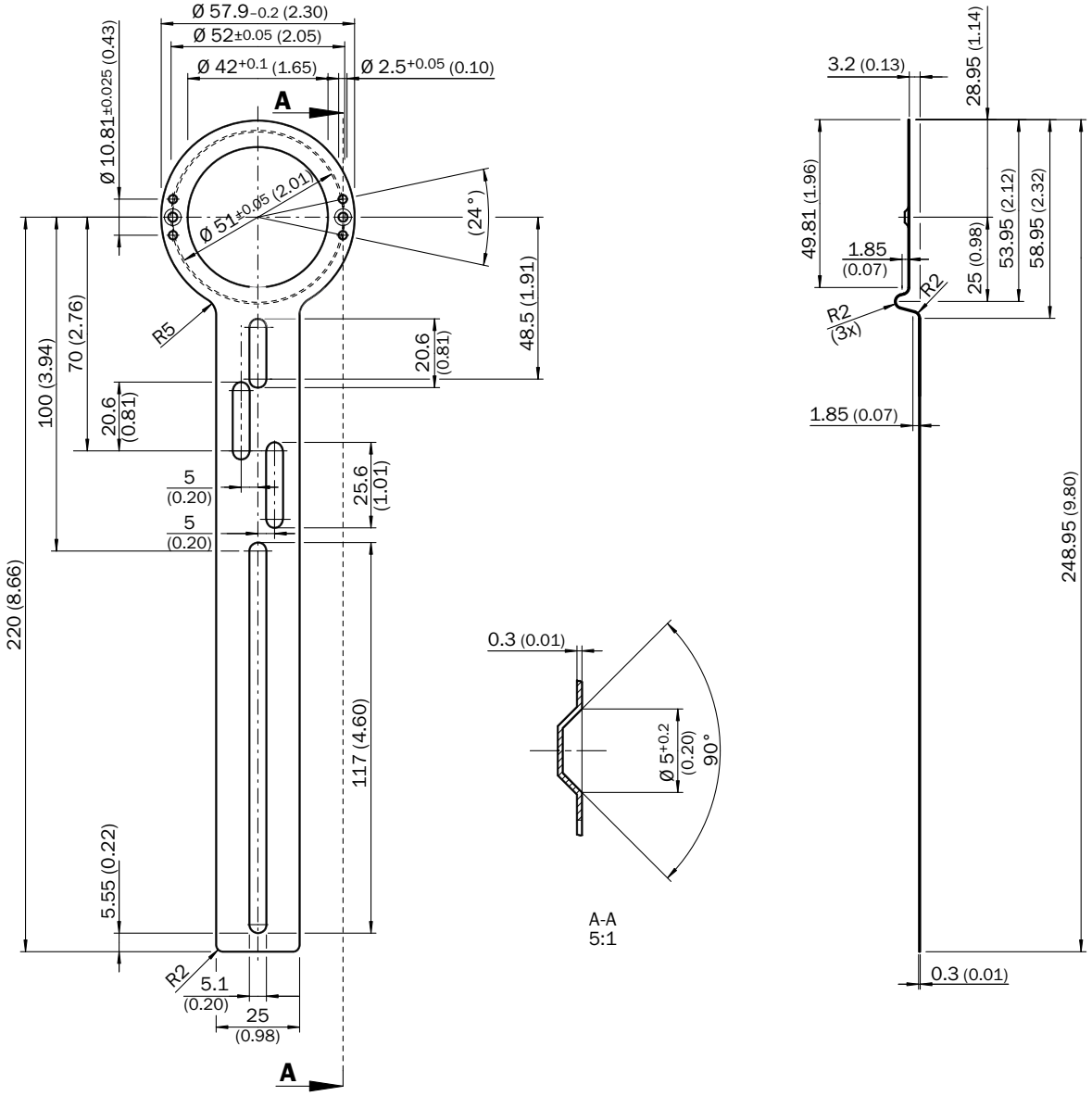
Version 1



Version 2


Ø 57.9-0.2 (2.30)
Ø 52±0.05 (2.05)
Ø 42+0.1 (1.65)
Ø 2.5+0.05 (0.10)
Ø 10.81±0.03 (0.43)
A
Ø 51±0.05 (2.01)
(24 °)
29.7 (1.17)
20.6 (0.81)
16.4 (0.65)
25.6 (1.01)
150 (5.90)
R5
5 (0.20)
49.7 (1.96)
94.7 (3.73)
20.6 (0.81)
10 (0.39)
133.7 (5.26)
25.6 (1.01)
R2
5.1 (0.20)
10.6 (0.42)
25 (0.98)
0.3 (0.01)
Ø 5+0.2 (0.20)
90°
A-A
5:1
3.2 (0.13)
28.95 (1.14)
49.81 (1.96)
1.85 (0.07)
25 (0.98)
53.95 (2.12)
58.95 (2.32)
R2
R2 (3x)
1.85 (0.07)
178.95 (7.05)

Version 3


Ø 57.9 -0.2 (2.30)
Ø 52±0.05 (2.05)
Ø 42+0.1 (1.65)
Ø 2.5+0.05 (0.10)
Ø 10.81±0.025 (0.43)
Ø 51±0.05 (2.01)
A
(24 °)
R5
48.5 (1.91)
20.6 (0.81)
100 (3.94)
70 (2.76)
20.6 (0.81)
5 (0.20)
5 (0.20)
25.6 (1.01)
220 (8.66)
117 (4.60)
5.55 (0.22)
R2
5.1 (0.20)
25 (0.98)
A
0.3 (0.01)
Ø 5+0.2 (0.20)
90°
A-A
5:1
3.2 (0.13)
28.95 (1.14)
49.81 (1.96)
1.85 (0.07)
25 (0.98)
53.95 (2.12)
58.95 (2.32)
R2
R2 (3x)
1.85 (0.07)
248.95 (9.80)
0.3 (0.01)

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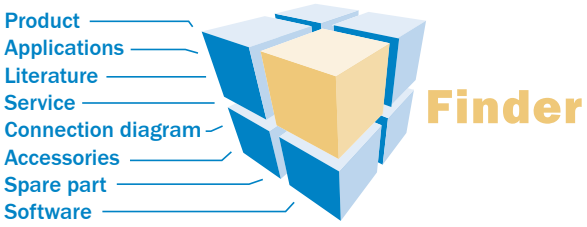

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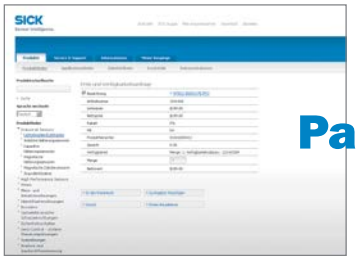

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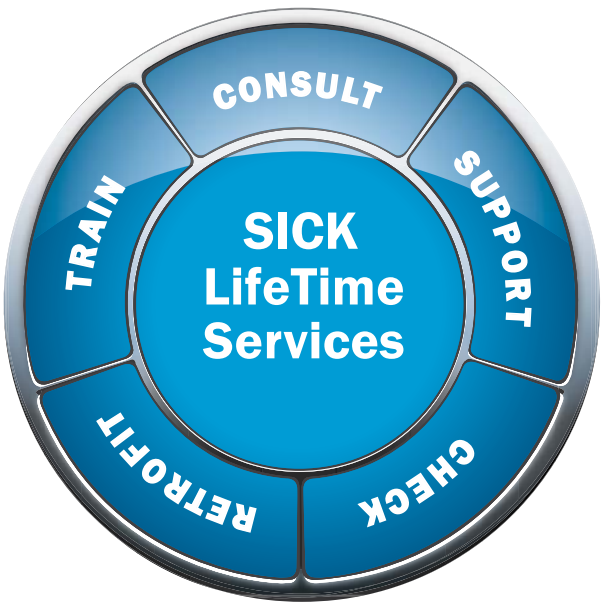
SICK LifeTime Services is a comprehensive set of high-quality services provided to support the entire life cycle of products and applications from system design all the way to upgrades. These services increase the safety of people, boost the productivity of machines and serve as the basis for our customers' sustainable business success.



Consulting & Design
Globally available experts for cost-effective solutions

Product & System Support
Fast and reliable, by telephone or on location

Verification & Optimization
Checks and recommendations for increased availability

Upgrade & Retrofits
Uncovers new potential for machines and systems

Training & Education
Employee qualification for increased competitiveness

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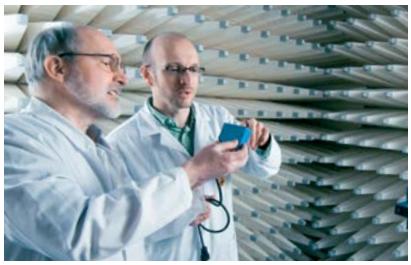
SICK at a glance



Leading technologies

With a staff of more than 6,000 and over 40 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
Brasil
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**

SICK
Sensor Intelligence.