



SFS / SFM60

HIGH-RESOLUTION MOTOR FEEDBACK SYSTEM

Motor feedback systems rotary HIPERFACE®

SICK
Sensor Intelligence.

HIGH-RESOLUTION MOTOR FEEDBACK SYSTEM IN HOLLOW SHAFT DESIGN



Product description

The SFS/SFM60 optical motor feedback systems round off SICK's portfolio with high-resolution motor feedback systems in hollow shaft design. Especially with self- and force-ventilated synchronous motors, this mechanical component meets customer requirements, as do various hollow shafts and high protection classes (IP 65). 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 connector outlet M12 or M23.

This implies greater mechanical flexibility and a multitude of possibilities! The SFS/SFM60 motor feedback systems use a globally standardized interface. It provides maximum flexibility and reduces installation times - plug & play at its best. The rugged shaft bearing increases the service life and at the same time reduces 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.

At a glance

- HIPERFACE® motor feedback system in singleturn and multiturn design, compatible with the world's leading drive systems
- 1,024 sine/ cosine periods per revolution
- Absolute position with a resolution of 32,768 increments per revolution and 4,096 revolutions with the multiturn system
- HIPERFACE® interface: programming of the position value and electronic type label
- Mechanical flexibility through different blind hollow shaft and through hollow shaft diameters (8 to 15 mm diameter), available with various stator couplings
- Unique ball bearing design, allowing for a ball bearing distance of 30 mm
- Universal cable outlet and common connector versions
- IP 65 protection class

Your benefits

- Convenient traceability and simple maintenance thanks to storage of motor-specific data in the electronic type label
- Large ball bearing distances reduce uneven wear and minimize vibration on the encoder housing, which increases the encoder's service life
- The nickel code disk offers a high degree of vibration resistance and an extended temperature range
- Shorter development times through standardized mechanical interface
- Platform for the future, since all electrical interfaces (TTL/HTL, 1Vpp, SSI, PROFIBUS, HIPERFACE DSL®) are or will be available in this mechanical component.



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→ www.mysick.com/en/SFS_SFM60

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



Detailed technical data

Performance

	Singleturn	Multiturn
Number of sine/cosine periods per revolution	1,024	
Total number of steps	32,768	134,217,728
Measurement step	0.3 angular seconds for interpolation of the sine/cosine signals with e.g. 12 bit	
Error limits for the digital absolute value	± 90 angular seconds (via RS 485)	
Typ. integral non-linearity	± 45 angular seconds (error limits for evaluating sine/cosine signals) with untensioned stator coupling	
Differential non-linearity	± 7 angular seconds (non-linearity of a sine/cosine period)	
Working speed	6,000 min ⁻¹ , up to which the absolute position can be reliably determined	

Interfaces

Code type for the absolute value	Binary
Code sequence	Ascending for clockwise shaft rotation, looking in direction 'A' (see dimensional drawing)
Interface signals	Process data channel SIN, REFSIN, COS, REFCOS: analog, differential Parameter channel RS 485: digital
Available memory area in E ² PROM 2048	1,792 bytes

Electrical data

Operating voltage range/supply voltage	7 V DC to 12 V DC
Recommended supply voltage	8 V DC
Operating current (no load)	< 80 mA
Output frequency for sine/cosine signals	0 kHz to 200 kHz

Mechanical data

Shaft type	Blind hollow shaft Through hollow shaft
Materials	
Shaft material	Stainless steel
Flange material	Zinc die-cast
Housing material	Aluminum die-cast
Dimensions	See dimensional drawing
Mass	0.2 kg
Rotor moment of inertia	40 gcm ²
Maximum operating speed ¹⁾	9,000 min ⁻¹
Maximum angular acceleration	≤ 500,000 rad/s ²
Operating torque	0.6 Ncm (at +20 °C)
Startup torque	0.8 Ncm (at +20 °C)
Permissible shaft movement, radial, static	± 0.3 mm

¹⁾ Self-heating approx. 3.3 K per 1,000 min⁻¹, note working temperature range in design.

	Singleturn	Multiturn
Permissible shaft movement, radial, dynamic	± 0.1 mm	
Permissible shaft movement, axial, static	±0.5 mm	
Permissible shaft movement, axial, dynamic	± 0.2 mm	
Service life of ball bearings	3.6 x 10 ⁹ revolutions	
Connection type	Male connector M23, 12-pin, radial Male connector M12, 8-pin, radial Cable, 8-wire universal, 1.5 m	

¹⁾ Self-heating approx. 3.3 K per 1,000 min⁻¹, note working temperature range in design.

Ambient conditions

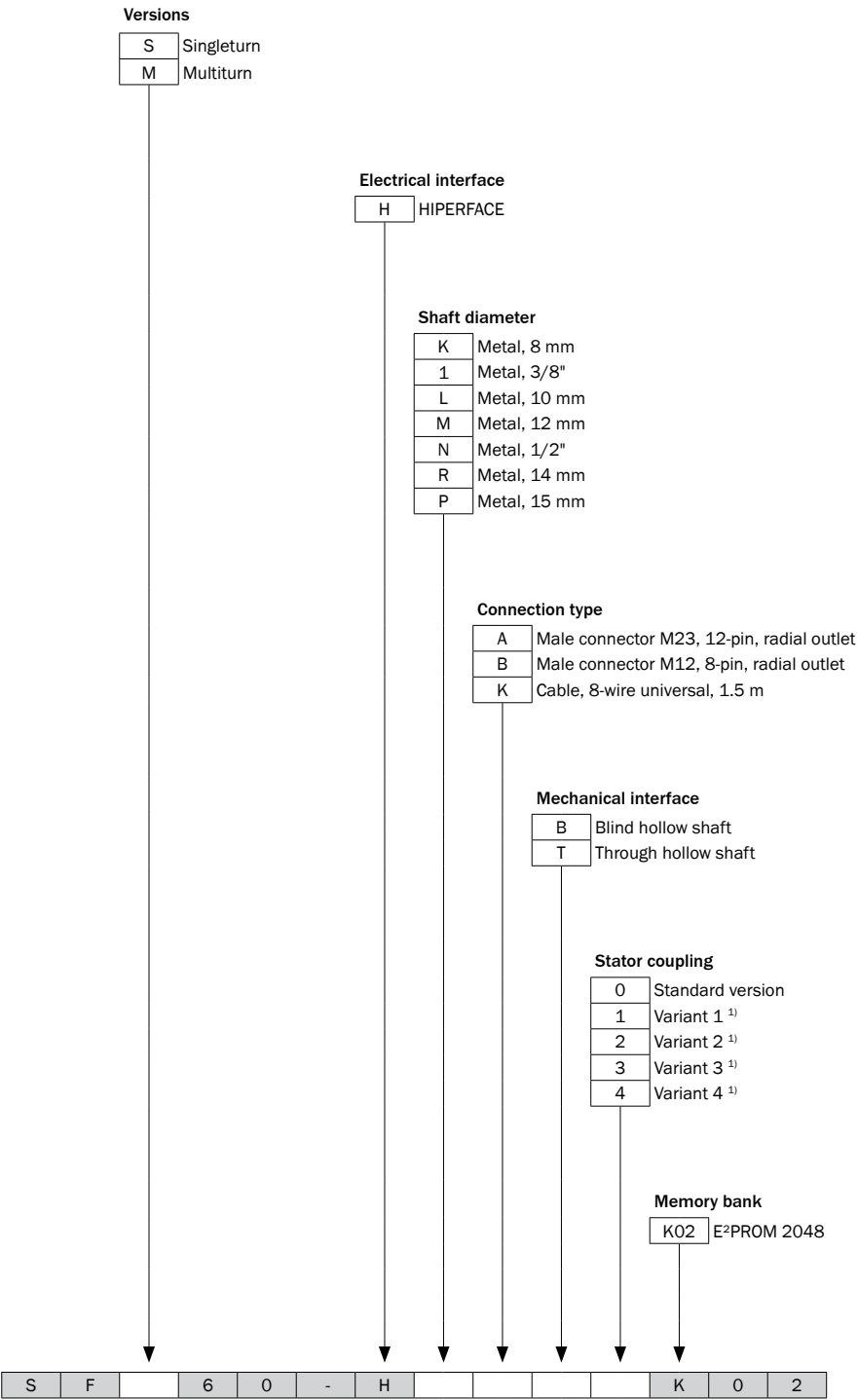
Working temperature range	-40 °C ... +115 °C
Storage temperature range	-40 °C to +115 °C, without packaging
Relative humidity/condensation	90 %, condensation not permitted
Resistance to shocks	100 g/6 ms (according to EN 60068-2-27)
Resistance to vibrations	20 g/10 Hz ... 2,000 Hz (according to EN 60068-2-6)
EMC	according to EN 61000-6-2 and EN 61000-6-3 ¹⁾
Enclosure rating	IP 65 with mating male connector connected (according to IEC 60529)

¹⁾ The EMC according to the standards quoted is achieved when the motor feedback system is mounted in an electrically conductive housing, which is connected to the central earthing point of the motor controller via a cable screen. The GND-(0V) connection of the supply voltage is also grounded. If other shielding concepts are used, the user must perform his own tests.

Ordering information

Other device versions available at www.mysick.com/en/SFS_SFM60

Type code



¹⁾ Variants 1 to 4 see accessories.

Data acquisition Singleturn

- **Electrical interface:** HIPERFACE®
- **Programmable/configurable:** ✓

Mechanical version	Connection type	Stator coupling	Model name	Part no.
Blind hollow shaft 12 mm	Cable	Variant 3	SFS60-HMKB3K02	1066060
Blind hollow shaft 14 mm	Cable	Standard version	SFS60-HRKB0K02	1052193
Through hollow shaft, 8 mm	Cable	Variant 4	SFS60-HKKT4K02	1066193
Through hollow shaft, 10 mm	M23 male connector	Standard version	SFS60-HLAT0K02	1052146
		Variant 4	SFS60-HLAT4K02	1053117
Through hollow shaft, 10 mm	Cable	Standard version	SFS60-HLKT0K02	1052142
		Variant 4	SFS60-HLKT4K02	1052166
Through hollow shaft, 12 mm	M23 male connector	Standard version	SFS60-HMAT0K02	1051085
		Variant 4	SFS60-HMAT4K02	1053185
Through hollow shaft, 12 mm	M12 male connector	Standard version	SFS60-HMBT0K02	1051088
		Variant 4	SFS60-HMBT4K02	1066342
Through hollow shaft, 12 mm	Cable	Standard version	SFS60-HMKT0K02	1051090
		Variant 4	SFS60-HMKT4K02	1052164
Through hollow shaft 1/2"	M23 male connector	Standard version	SFS60-HNAT0K02	1052148
Through hollow shaft 1/2"	Cable	Standard version	SFS60-HNKT0K02	1052143
		Variant 4	SFS60-HNKT4K02	1052168
Through hollow shaft, 14 mm	M23 male connector	Standard version	SFS60-HRAT0K02	1051086
		Variant 3	SFS60-HRAT3K02	1054036
		Variant 4	SFS60-HRAT4K02	1052866
Through hollow shaft, 14 mm	Cable	Standard version	SFS60-HRKT0K02	1051091
		Variant 4	SFS60-HRKT4K02	1052162
Through hollow shaft, 15 mm	Cable	Standard version	SFS60-HPKT0K02	1050531

Data acquisition Multiturn

- **Electrical interface:** HIPERFACE®
- **Programmable/configurable:** ✓

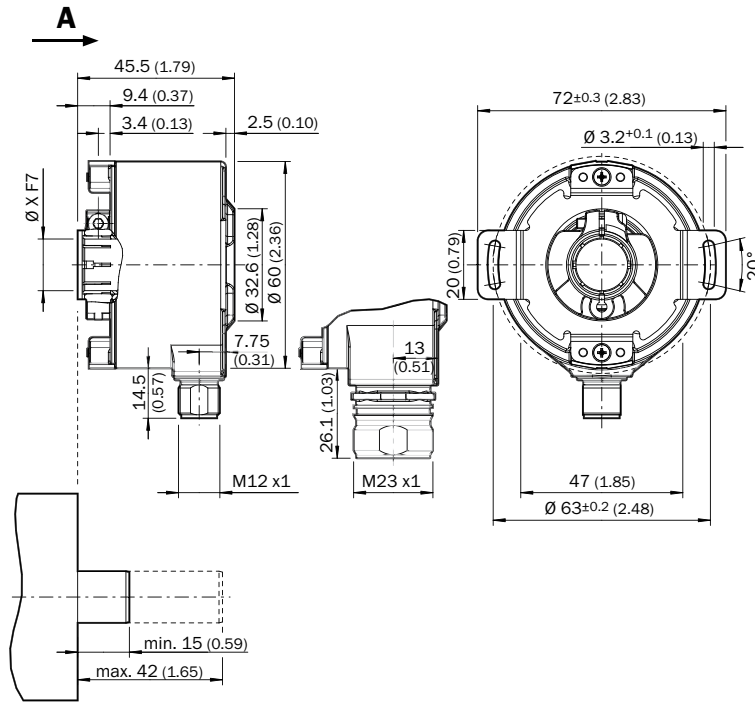
Mechanical version	Connection type	Stator coupling	Model name	Part no.
Blind hollow shaft 8 mm	M23 male connector	Standard version	SFM60-HKAB0K02	1064321
Blind hollow shaft 3/8"	M12 male connector	Standard version	SFM60-H1BB0K02	1062801
Blind hollow shaft 10 mm	M12 male connector	Standard version	SFM60-HLBB0K02	1054267
Blind hollow shaft 12 mm	M23 male connector	Standard version	SFM60-HMAB0K02	1053160
		Variant 4	SFM60-HMAB4K02	1053373
Blind hollow shaft 12 mm	Cable	Standard version	SFM60-HMKB4K02	1053626
Blind hollow shaft 14 mm	Cable	Standard version	SFM60-HRKB0K02	1052192
Blind hollow shaft 15 mm	M23 male connector	Standard version	SFM60-HPAB0K02	1051085
Blind hollow shaft 15 mm	M12 male connector	Standard version	SFM60-HPBB0K02	1053042
Blind hollow shaft 15 mm	Cable	Standard version	SFM60-HPKB0K02	1053044
		Variant 4	SFM60-HPKB4K02	1053045
Through hollow shaft, 8 mm	M23 male connector	Standard version	SFM60-HKAT0K02	1051817
Through hollow shaft, 10 mm	M23 male connector	Standard version	SFM60-HLAT0K02	1052145
		Standard version	SFM60-HLAT4K02	1053229

Mechanical version	Connection type	Stator coupling	Model name	Part no.
Through hollow shaft, 10 mm	Cable	Standard version	SFM60-HLKT0K02	1052140
		Variant 4	SFM60-HLKT4K02	1052165
Through hollow shaft, 12 mm	M23 male connector	Standard version	SFM60-HMAT0K02	1051086
		Variant 4	SFM60-HMAT4K02	1053367
Through hollow shaft, 12 mm	M12 male connector	Standard version	SFM60-HMBT0K02	1051089
Through hollow shaft, 12 mm	Cable	Standard version	SFM60-HMKT0K02	1051091
		Variant 4	SFM60-HMKT4K02	1052163
Through hollow shaft 1/2"	M23 male connector	Standard version	SFM60-HNAT0K02	1052147
Through hollow shaft 1/2"	Cable	Standard version	SFM60-HNKT0K02	1052157
		Variant 4	SFM60-HNKT4K02	1052167
Through hollow shaft, 14 mm	M23 male connector	Standard version	SFM60-HRAT0K02	1050529
		Variant 4	SFM60-HRAT4K02	1052258
Through hollow shaft, 14 mm	Cable	Standard version	SFM60-HRKT0K02	1050527
		Variant 4	SFM60-HRKT4K02	1052161
Through hollow shaft, 15 mm	M23 male connector	Standard version	SFM60-HPAT0K02	1065325
		Variant 4	SFM60-HPAT4K02	1053777
Through hollow shaft, 15 mm	M12 male connector	Standard version	SFM60-HPBT0K02	1053366
Through hollow shaft, 15 mm	Cable	Standard version	SFM60-HPKT0K02	1051311

Dimensional drawings (dimensions in mm (inch))

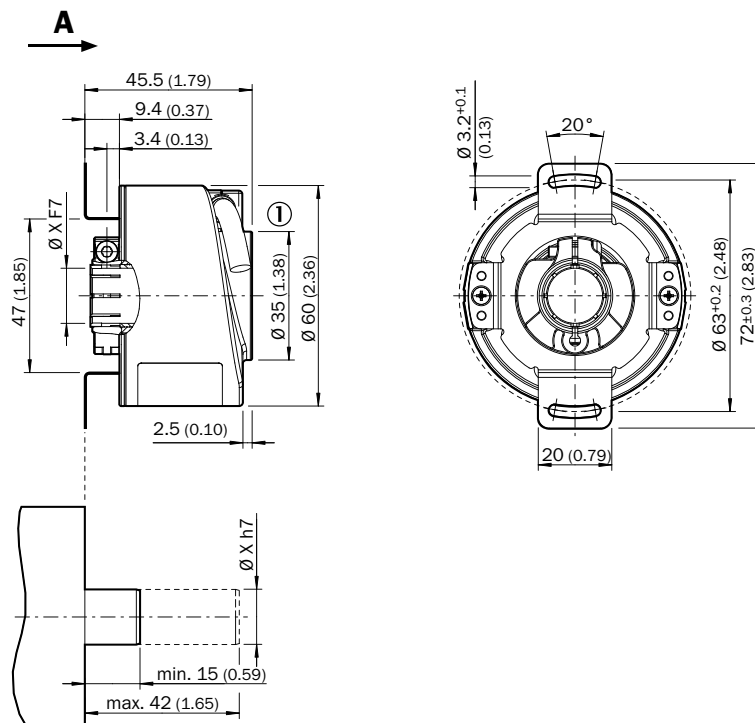
Blind hollow shaft, connector outlet

General tolerances according to ISO 2768-mk



Blind hollow shaft, cable outlet

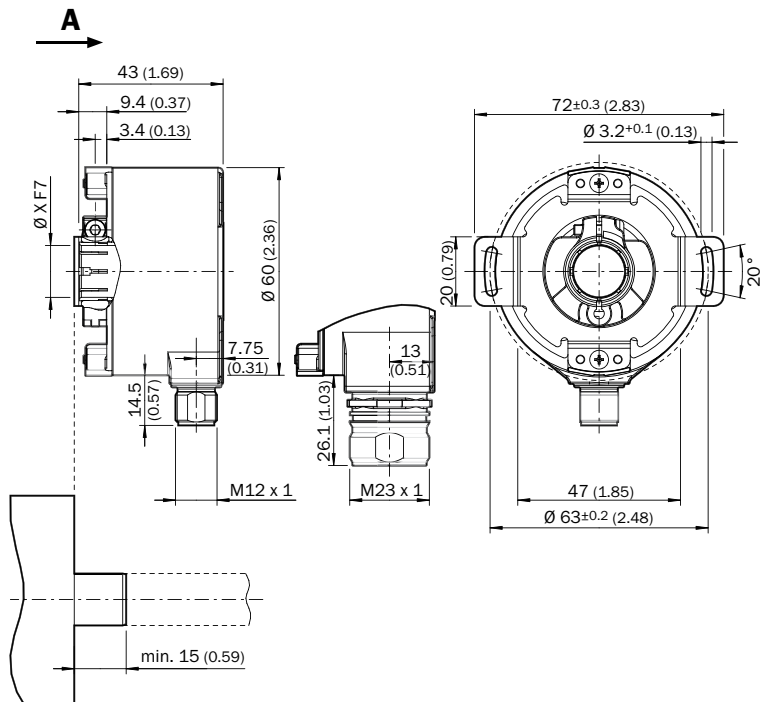
General tolerances according to ISO 2768-mk



① Cable diameter = 5.6 mm +/- 2 mm bend radius = 30 mm

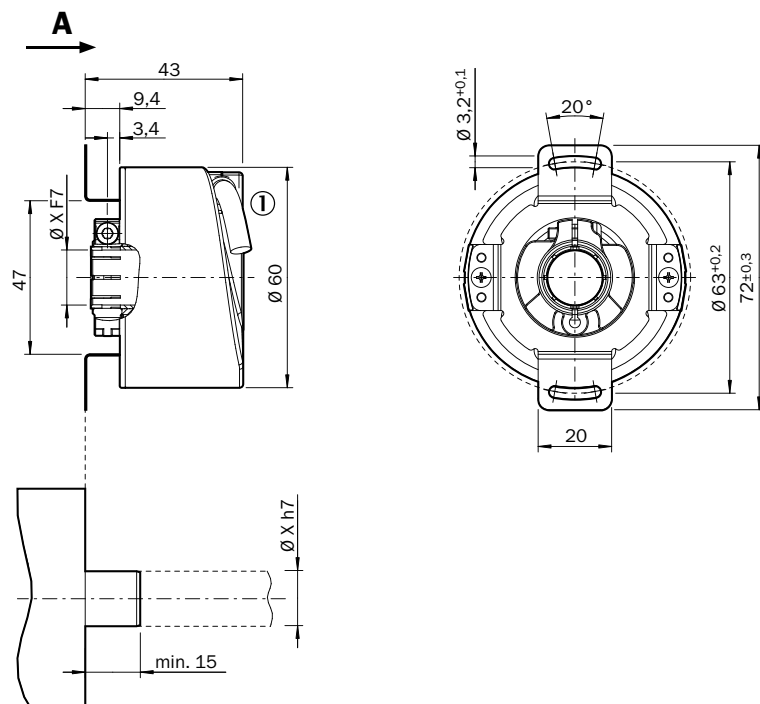
Through hollow shaft, connector outlet

General tolerances according to ISO 2768-mk



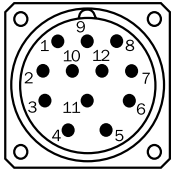
Through hollow shaft, cable outlet

General tolerances according to ISO 2768-mk



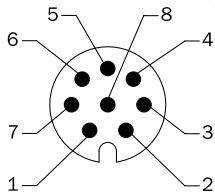
① Cable diameter = 5.6 mm +/- 2 mm bend radius = 30 mm

Pin assignment



View of the plug-in face Screen connected at the connector housing

PIN	Signal	Explanation
1	REFCOS	Process data channel
2	Data +	RS485 parameter channel
3	N. C.	Not yet assigned
4	N. C.	Not yet assigned
5	+SIN	Process data channel
6	REFSIN	Process data channel
7	Data -	RS485 parameter channel
8	+COS	Process data channel
9	N. C.	Not yet assigned
10	GND	Ground connection
11	N. C.	Not yet assigned
12	U _s	Supply voltage 7 V ... 12 V
Connector housing	Screen	Screen connected with encoder housing



View of the plug-in face Screen connected at the connector housing

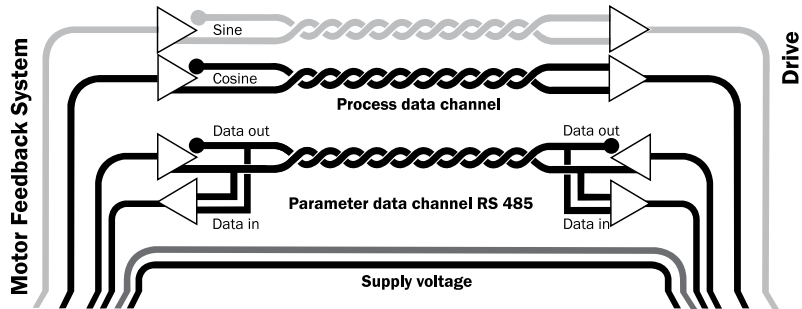
PIN	Signal	Explanation
1	REFSIN	Process data channel
2	+SIN	Process data channel
3	REFCOS	Process data channel
4	+COS	Process data channel
5	Data +	RS485 parameter channel
6	Data -	RS485 parameter channel
7	GND	Ground connection
8	+U _s	Supply voltage 7 V ... 12 V
Connector housing	Screen	Screen connected with encoder housing

Wire colors	Signal	Explanation
Brown	REFSIN	Process data channel
White	+SIN	Process data channel
Black	REFCOS	Process data channel
Pink	+COS	Process data channel
Gray or Yellow	Data +	RS485 parameter channel
Green or Violet	Data -	RS485 parameter channel
Blue	GND	Ground connection
Red	+U _s	Supply voltage 7 V ... 12 V
Screen		Screen connection on the connector housing



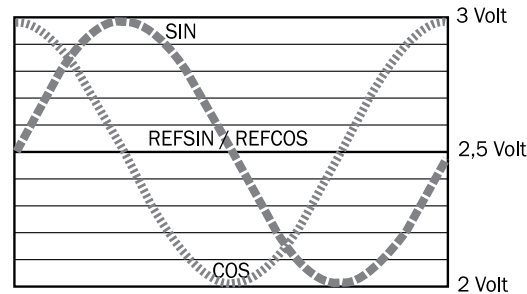
Electrical interface

- Secure data transmission
- High information content
- Electronic type label
- Just 8 leads
- Bus-compatible parameter channel
- Process channel in real time



Signal specification of the process channel

Signal diagram for clockwise shaft rotation, looking in direction 'A' (see dimensional drawing)



1 period = 360° : 1,024

Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always 'online'. When the supply voltage is applied, the speed controller has access to this information at any time. Sophisticated technology guarantees stable amplitudes of the analogue signals across all specified environmental conditions, with a maximum variation of only 20 %.

Characteristics applicable to all stated ambient conditions	
Signal	Values/unit
Signal peak, peak V_{pp} of SIN, COS	0.9 V ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 V ... 2.8 V

Model-specific settings	SFS	SFM
Model ID (command 52h)	22h	27h
Free E ² PROM [bytes]	128/1,792	128/1,792
Address	40h	40h
Mode_485	E4h	E4h
Codes 0 to 3	55h	55h
Counter	0	0

Overview of supported commands			SFS	SFM
Command byte	Function	Code 0 ¹⁾	Comment	Comment
42h	Read position			
43h	Set position	■		
44h	Read analog value		Channel number 48h	Channel number 48h
			Temperature [°C]	Temperature [°C]
46h	Read counter			
47h	Increase counter			
49h	Delete counter	■		
4Ah	Read data			
4Bh	Store data			
4Ch	Determine status of a data field			
4Dh	Create data field			
4Eh	Determine available memory area			
4Fh	Change access code			
50h	Read encoder status			
52h	Read out type label		Encoder type=22h	Encoder type=27h
53h	Encoder reset			
55h	Allocate encoder address	■		
56h	Read serial number and program version			
57h	Configure serial interface	■		

¹⁾The commands thus marked include the parameter 'Code 0'. Code 0 is a byte inserted into the protocol to provide additional protection of vital system parameters against accidental overwriting. When the device is supplied, 'Code 0' = 55h.

Overview of status messages				
	Status code	Description	SFS	SFM
Error type	00h	The encoder has not detected any faults	■	■
	01h	Incorrect alignment data	■	■
Initialization	02h	Incorrect internal angular offset	■	■
	03h	Data field partitioning table destroyed	■	■
	04h	Analog limit values not available	■	■
	05h	Internal I2C bus inoperative	■	■
	06h	Internal checksum error	■	■
	07h	Encoder reset occurred as a result of program monitoring	■	■
Protocol	09h	Parity error	■	■
	0Ah	Checksum of transmitted data is incorrect	■	■
	0Bh	Unknown command code	■	■
	0Ch	Number of transmitted data is incorrect	■	■
	0Dh	Transmitted command argument is not allowed	■	■
	0Eh	The selected data field may not be written to	■	■
Data	0Fh	Incorrect access code	■	■
	10h	Size of specified data field cannot be changed	■	■
	11h	Specified word address lies outside the data field	■	■
	12h	Access to non-existent data field	■	■
Position	01h	Analog signals outside specification	■	■
	1Fh	Speed too high, no position formation possible	■	■
	20h	Singleturn position unreliable	■	■
	21h	Multiturn position error		■
	22h	Multiturn position error		■
	23h	Multiturn position error		■
Other	1Ch	Value monitoring of the analog signals (process data)	■	■
	1Dh	Transmitter current critical (contamination, transmitter breakage)	■	■
	1Eh	Encoder temperature critical	■	■
	08h	Counter overflow	■	■

For more information on the interface see HIPERFACE® - description, part no. 8010701





Accessories

Programming and configuration tools


Accessory category	Brief description	Model name	Part no.
Other accessories	sVip® LAN programming tool for all motor feedback systems	PGT-11-S	1057324
Other accessories	sVip® WLAN programming tool for all motor feedback systems	PGT-11-S	1067474

Mounting systems

Stator couplings


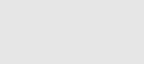
Figure	Accessory category	Brief description	Variant	Model name	Part no.
	Mounting systems	Stator coupling, one-sided, 81 mm long with slot	1	BEF-DS01DFS/VFS	2047428
		Stator coupling, one-sided, 179 mm long with slot	2	BEF-DS02DFS/VFS	2047430
		Stator coupling, one-sided, 248 mm long with slots	3	BEF-DS03DFS/VFS	2047431
		Stator coupling, 16.5 mm high	4	BEF-DS05XFX	2057423

Insulated shaft connection



Figure	Exterior diameter	Interior 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

Plug connectors and cables

Connecting cable (female connector open)

Figure	Brief description	Length of cable	Model name	Part no.
	Female cable connector, 8-pin, straight, pre-wired with 8-core cable, 4 x 2 x 0.25 mm², screened, cable diameter 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
	Female connector, M23, 12-pin, straight, cable HIPERFACE®, suitable for drag chain, PUR, screened	1.5 m	DOL-2308-G1M5JB2	2031069
		3 m	DOL-2308-G03MJB2	2031070
		5 m	DOL-2308-G05MJB2	2031071
		10 m	DOL-2308-G10MJB2	2031072
		15 m	DOL-2308-G15MJB2	2031073



Female connector (ready to assemble)

Figure	Brief description	Model name	Part no.
	Female connector, M12, 8-pin, straight, A-coded, incremental, SSI, screened	DOS-1208-GA01	6045001
	Female connector, M23, 12-pin, straight, HIPERFACE®, SSI, incremental, screened	DOS-2312-G	6027538

Cable (open-open)

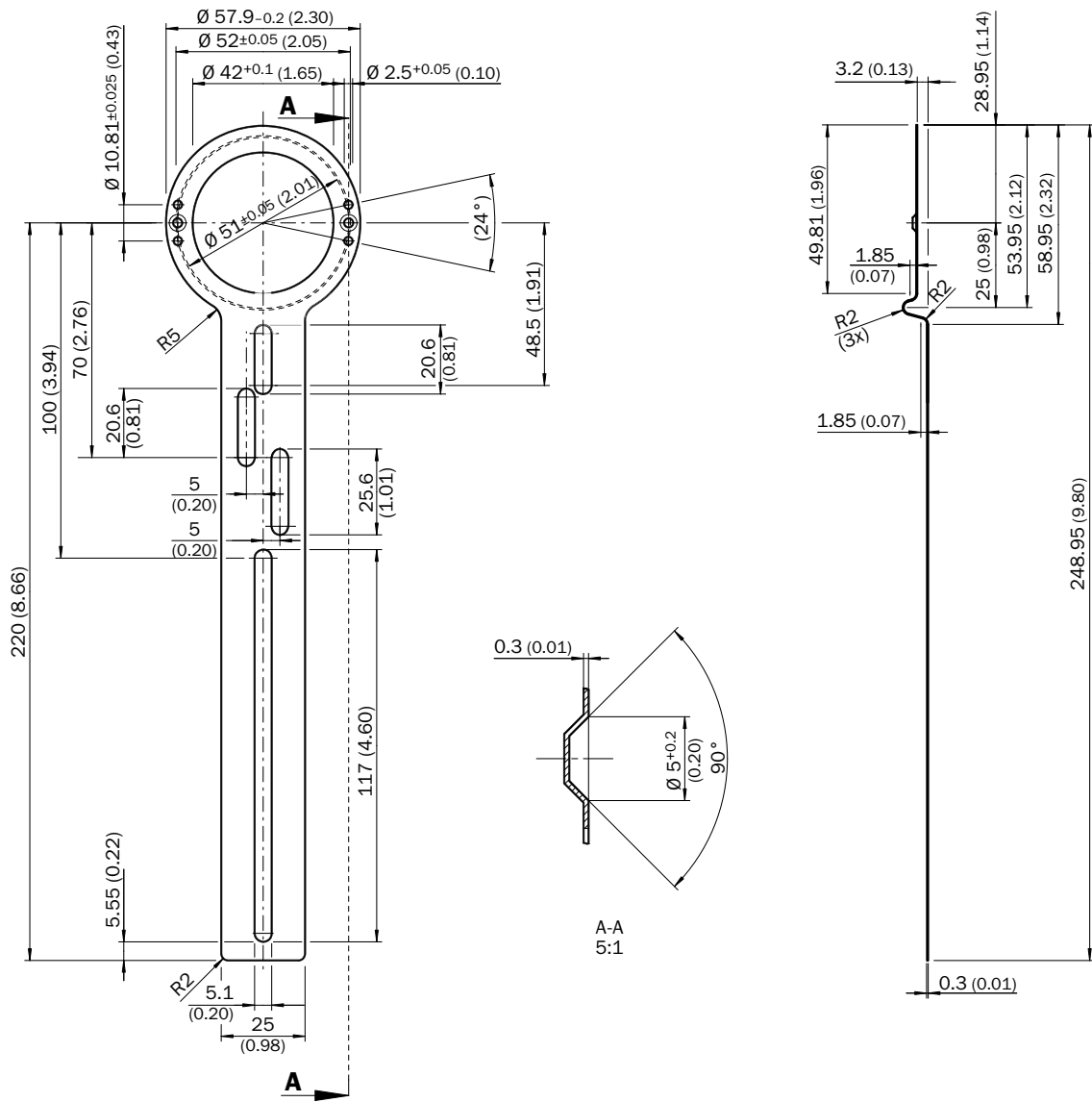
Brief description	Model name	Part no.
Cable, HIPERFACE®, suitable for drag chain, PUR halogen free, screened	LTG-2708-MW	6028361

Male connector (ready to assemble)

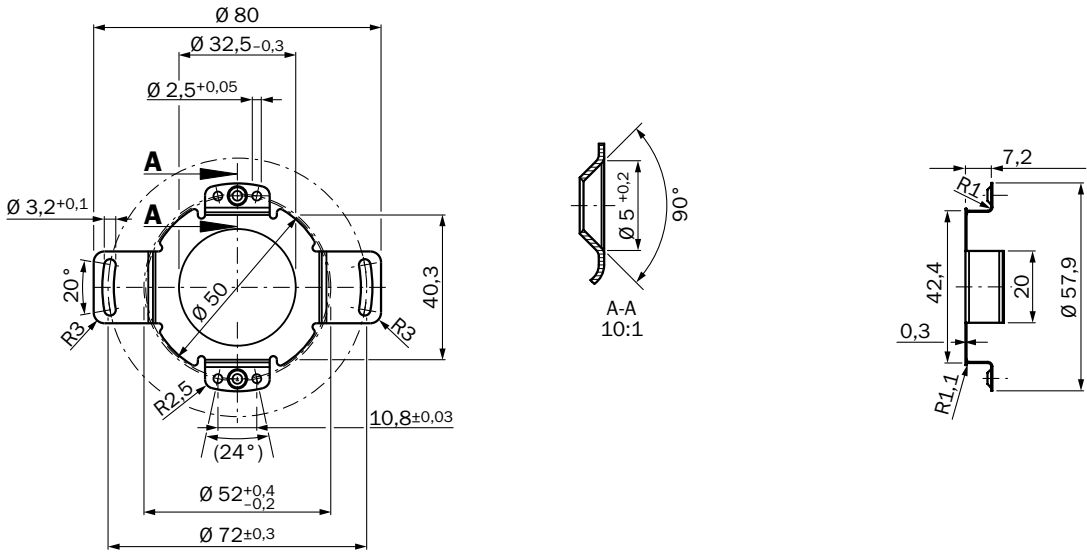
Figure	Brief description	Model name	Part no.
	Male connector, M12, 8-pin, straight, A-coded, incremental, screened	STE-1208-GA01	6044892
	Male connector, M23, 12-pin, straight, HIPERFACE®, SSI, incremental, RS422, screened	STE-2312-G	6027537

Warning! Accessories for the working temperature range -40 °C on request.

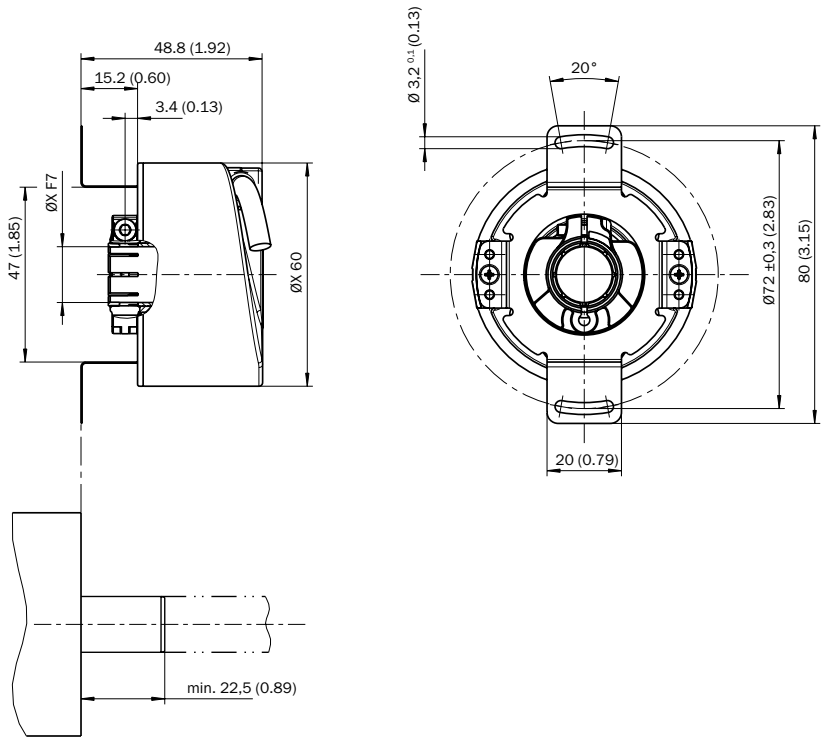
BEF-DS03DFS/VFS (variant 3)



BEF-DS05XFX (variant 4)

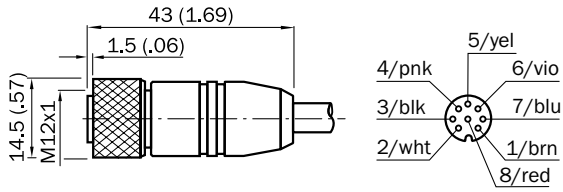


Installation example (variant 4)



Plug connectors and connecting cables (female connector-open)

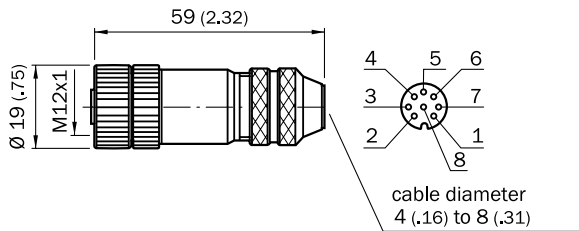
DOL-1208-G02MAC1
DOL-1208-G05MAC1
DOL-1208-G10MAC1
DOL-1208-G20MAC1



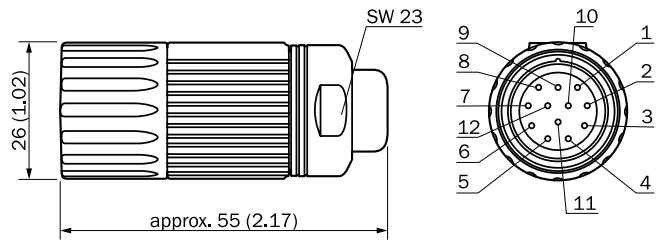
All dimensions in mm (inch)

Plug connectors and female connector cables (ready to assemble)

DOS-1208-GA01

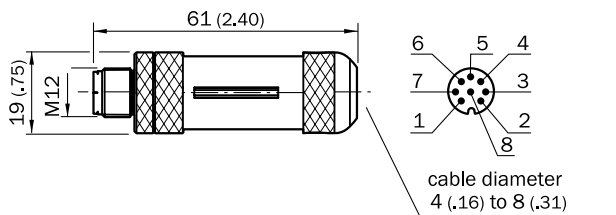


DOS-2312-G

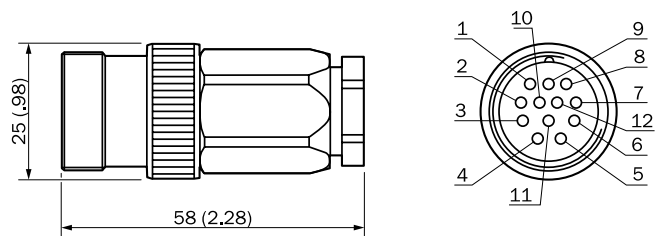


Plug connectors and male connector cables (ready to assemble)

STE-1208-GA01

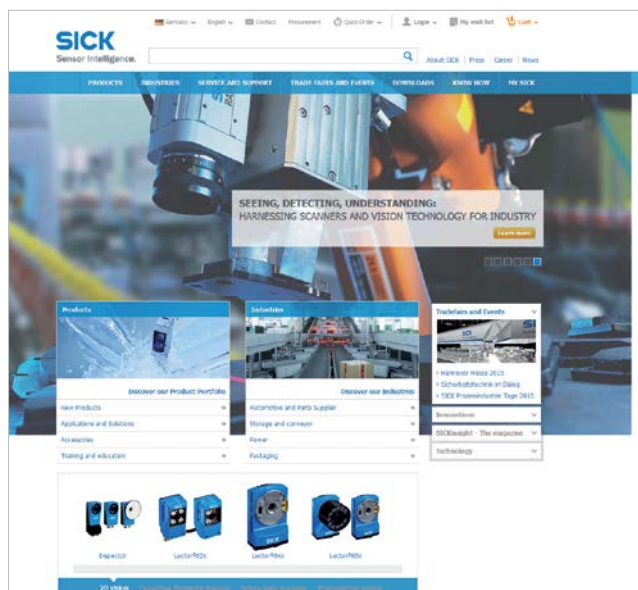


STE-2312-G



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Safe and professional



Product and system support
Reliable, fast and on-site



Verification and optimization
Safe and regularly inspected



Upgrade and retrofits
Easy, safe and economical



Training and education
Practical, focused and professional

SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With almost 7,000 employees and over 50 subsidiaries and equity investments as well as numerous representative offices worldwide, we are always close to our customers. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

We have extensive experience in various industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services round out our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

For us, that is “Sensor Intelligence.”

Worldwide presence:

Australia, Austria, Belgium, Brazil, Canada, Chile, China, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, India, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, Romania, Russia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, USA, Vietnam.

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