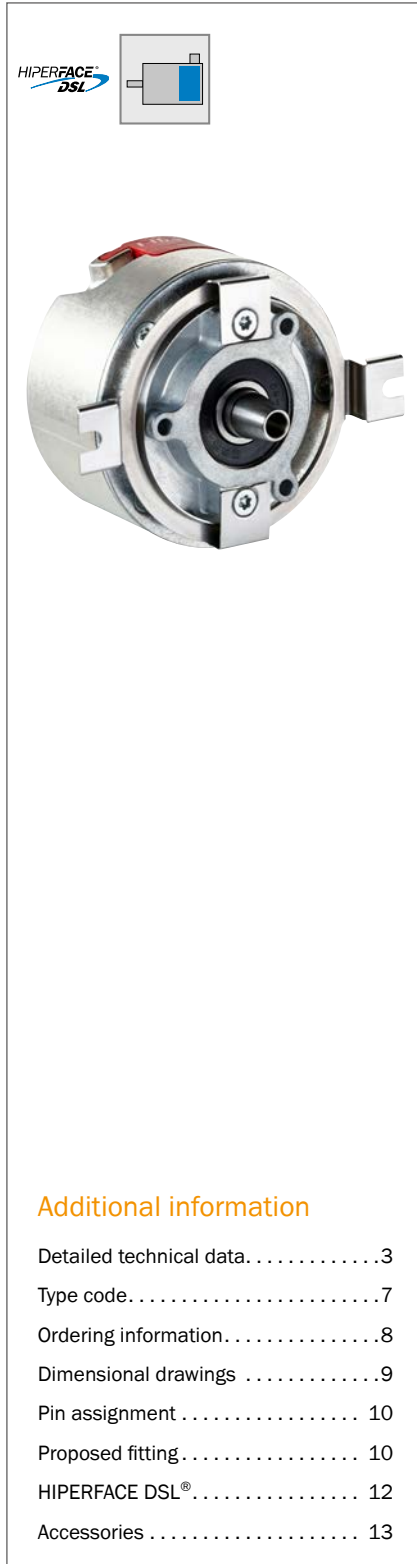# EFS/EFM50

HIGH-RESOLUTION MOTOR FEEDBACK SYSTEM FOR DYNAMIC SERVO DRIVES

Motor feedback system rotary HIPERFACE DSL®

SICK
Sensor Intelligence.

HIGH-PRECISION MOTOR FEEDBACK SYSTEM FOR HIGHLY DYNAMIC SERVO DRIVES

Product description

The EFS/EFM50 motor feedback system features a compact and rugged design with a diameter of 50 mm. In combination with the absolute determination of positions of the motor feedback system, a resolution of up to 23 bits per revolution and a maximum of 4,096 revolutions, this design is unique in its class.

At a glance

- Motor feedback system with HIPERFACE DSL® interface
- Compact, rugged design with 50 mm diameter
- Up to 23-bit resolution per revolution and 4,096 revolutions measurable with the multiturn system
- Facility for connecting an external temperature sensor
- E²Prom with 8 KB of free memory space
- SIL2-certified (only valid for EFS/EFM50-2)
- 12-bit resolution of the safe position value
- Usage histogram

Your benefits

- Thanks to data transmission exclusively in digital format, no analog components are necessary on the controller side
- The absence of a separate encoder cable considerably reduces costs. Data transmission is synchronized with the controller cycle.
- Minimum cabling thanks to integration of encoder communication into the motor cable
- Optimization of the controller circuit via automated synchronization with the controller cycle

Additional information

➜ www.mysick.com/en/EFS_EFM50

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 21 bit	Singleturn 23 bit	Multiturn 21 bit	Multiturn 23 bit
Resolution per revolution	21 bit	23 bit	21 bit	23 bit
Positioning noise in angular seconds (σ)	± 2			
Number of absolute ascertainable revolutions	1		4,096	
Measurement steps per revolution	2,097,152	8,388,608	2,097,152	8,388,608
Error limits position value integral non-linearity in angular seconds	± 45 [1]			
Error limits position value differential non-linearity in angular seconds	± 7 [1]	± 5 [1]	± 7 [1]	± 5 [1]
Max. speed when switching on/resetting the motor feedback system	≤ 6,000 rpm			
Available memory space	8,192 bytes			

[1] See notes on the technical data

Interfaces

Code sequence	Increasing, when turning the shaft. For clockwise rotation, looking in direction "A" (see dimensional drawing).
Communication interface	HIPERFACE DSL® [1]
Initialization time	Max. 500 ms [2]
Measurement of external temperature resistance	32-bit value, without sign (1 Ω) 0 ... 209,600 Ω[3]

[1] For connection with a drive, the "DSL Master" IP core must be implemented in the drive, see manual for HIPERFACE DSL® (8017595)

[2] From reaching a permitted supply voltage.

[3] Without sensor tolerance; at −17 °C ... +167 °C: NTC +-2K (103 GT); PTC+-3K (KTY84/130)

Electrical data

Supply voltage range	7 V ... 12 V
Warm-up time voltage ramp	Max. 180 ms [1]
Operating current	Max. 150 mA [2]

[1] Duration of the voltage ramp between 0 and 7.0 V. See diagram 2.

[2] When using the proposed input line as described in the manual for HIPERFACE DSL® (8017595).

Mechanical data

	Singleturn 21 bit	Singleturn 23 bit	Multiturn 21 bit	Multiturn 23 bit
Dimensions	See dimensional drawing			
Weight	≤ 0.2 kg			
Rotor moment of inertia	10 gcm²			
Maximum operating speed	≤ 12,000 rpm		≤ 9,000 rpm	
Start up torque at 20 °C	≤ 0.4 Ncm			
Service life of ball bearings	3.6 x 10^9 revolutions			
Permissible shaft movement, radial, static	± 0.2 mm [1]			
Permissible shaft movement, radial, dynamic	± 0.1 mm for standard devices ± 0.025 mm for safety devices			
Permissible shaft movement, axial	± 0.95 mm			
Max. permissible angular acceleration	200,000 rad/s²			

[1] Permitted when using the elastomer stator coupling. When the spring plate stator coupling is being used, voltage-free mounting is assumed

Ambient conditions

Operating temperature range [1]	
Standard device	–30 °C … +120 °C
Safety device	–30 °C … +115 °C
Storage temperature range	–40 °C … +120 °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, EN 61000-6-3, and IEC 61326-3-1) [2]
Enclosure rating	IP 40 (according to IEC 60529-1), with cover closed

[1] For typical values for self-heating, refer to diagram 3 (electrical) and diagram 4 (mechanical).

[2] EMC according to the listed standards is guaranteed if the motor feedback system with mating plug inserted is connected to the central grounding point of the motor controller via a cable shield. If other shielding concepts are used, users must perform their own tests. Class A device.

Safety technology parameters (only valid for SIL2 certified versions)

Safety integrity level	SIL2 (IEC 61508), SILCL2 (EN 62061) [1]
Systematic suitability	SC 3 (IEC 61508)
Probability of a dangerous failure per hour (PFH$_D$)	3.8×10^{-8}
Mission time (T$_M$)	
with spring mounting plate	20 years
with resolver support	10 years
Safety-related accuracy [2]	
with spring mounting plate	± 0.09°
with resolver support	± 0.2°
Category	3 (EN ISO 13849)
Test rate	1 h
Maximum demand time	216 µs
Performance level	PL d (EN ISO 13849)
Safety-related resolution	Channel 1 = 21 or 23 bit, channel 2 = 12 bit

[1] For more detailed information on the exact configuration of your machine/system, please consult your local SICK subsidiary.

[2] The safety-related accuracy indicates the maximum position error limit with which the safety functions can be supported.

Notes on the technical data
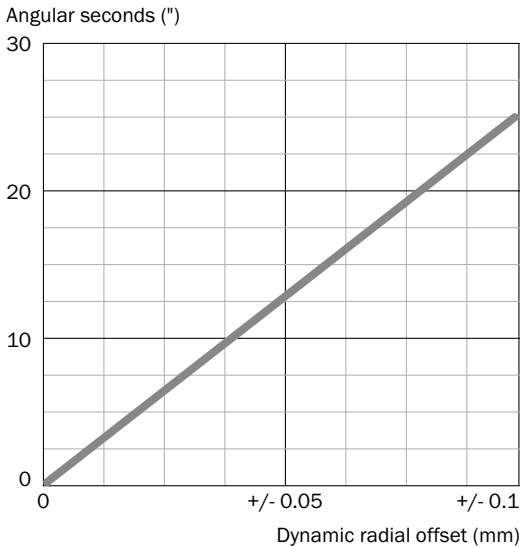
Error limits

The specific values for non-linearities apply to an ambient temperature of 20 °C and torque supports installed in a stress-free manner.

DNL: The differential non-linearity may deteriorate from the room temperature to the maximum operating temperature by ± 2".

INL: For restrictions of the integral non-linearity, see diagram 1. The diagram shows the effects of the deformation of the torque supports with corresponding dynamic radial deviations in angular seconds. This error must be added to the specified error limits for the integral non-linearity.

The axial deviation has no effect on the error limits for the integral non-linearity in the specified tolerance range.
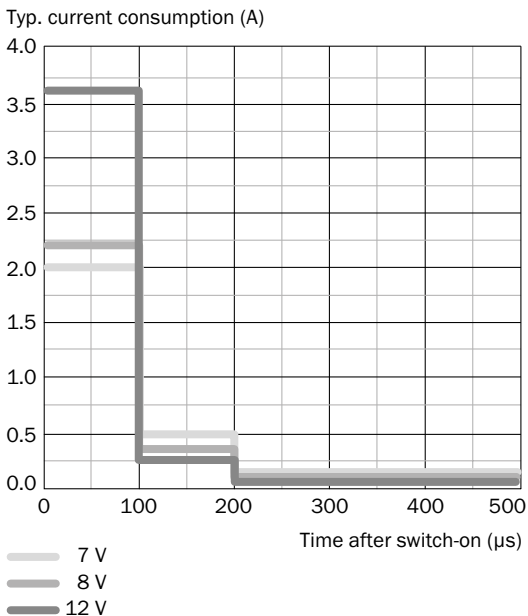
Diagram 1

Angular seconds (")

Dynamic radial offset (mm)

Current consumption

Diagram 2 shows the switch-on current.

Diagram 2

Typ. current consumption (A)

Time after switch-on (µs)

- 7 V
- 8 V
- 12 V

Self-heating

The max. internal encoder temperature may not exceed 125 °C. The defined measuring point on the encoder (see dimensional drawing) must be used for measuring the operating temperature.

For typical values for self-heating, refer to diagram 4 (electrical) and diagram 5 (mechanical).

Electrical self-heating is generated using the current consumption of the encoder. It is dependent on the ambient temperature of the encoder.

Mechanical self-heating is generated using the ball bearings of the encoder. It is dependent on the speed of the encoder and the ambient temperature.
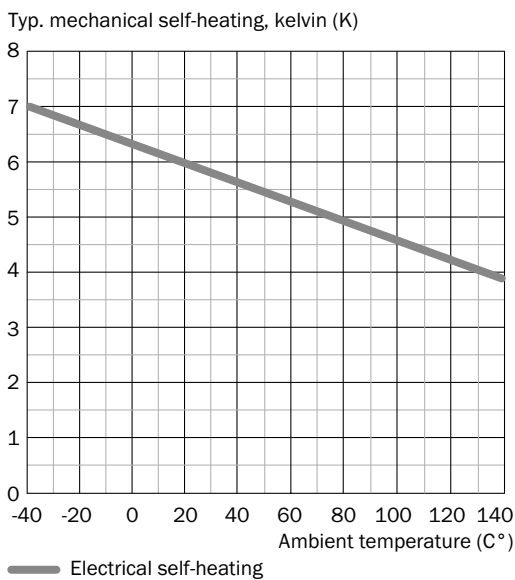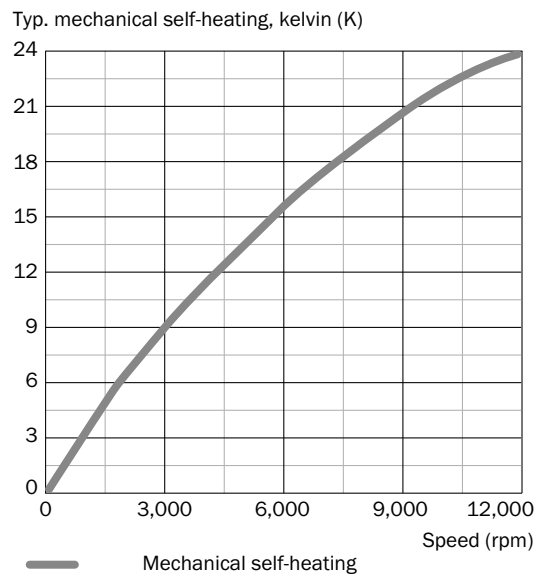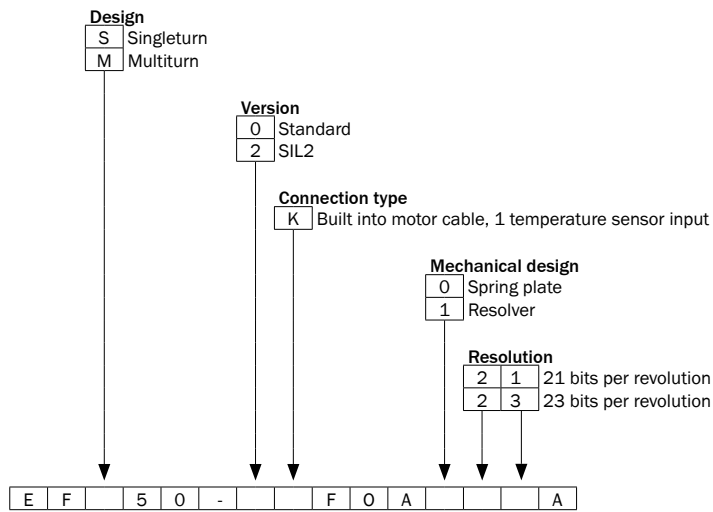
Diagram 3

Typ. mechanical self-heating, kelvin (K)

Ambient temperature (C°)

──── Electrical self-heating

Diagram 4

Typ. mechanical self-heating, kelvin (K)

Speed (rpm)

──── Mechanical self-heating

Type code

Type code

Design
| S | Singleturn |
| M | Multiturn |

Version
| 0 | Standard |
| 2 | SIL2 |

Connection type
| K | Built into motor cable, 1 temperature sensor input |

Mechanical design
| 0 | Spring plate |
| 1 | Resolver |

Resolution
| 2 | 1 | 21 bits per revolution |
| 2 | 3 | 23 bits per revolution |

| E | F | | 5 | 0 | - | | | F | 0 | A | | | | A |

Ordering information

Singleturn

- **Electrical interface:** HIPERFACE DSL®

Torque support	Type	Part no.
Spring mounting plate	EFS50-0KF0A021A	1073485
	EFS50-0KF0A023A	1073501
Resolver support	EFS50-0KF0A121A	1073493
	EFS50-0KF0A123A	1073509

Singleturn

- **Safety system:** ✔
- **Electrical interface:** HIPERFACE DSL®

Torque support	Type	Part no.
Spring mounting plate	EFS50-2KF0A021A	1073487
	EFS50-2KF0A023A	1073503
Resolver support	EFS50-2KF0A121A	1073495
	EFS50-2KF0A123A	1073511

Multiturn

- **Electrical interface:** HIPERFACE DSL®

Torque support	Type	Part no.
Spring mounting plate	EFM50-0KF0A021A	1073486
	EFM50-0KF0A023A	1073502
Resolver support	EFM50-0KF0A121A	1073494
	EFM50-0KF0A123A	1073510

Multiturn

- **Safety system:** ✔
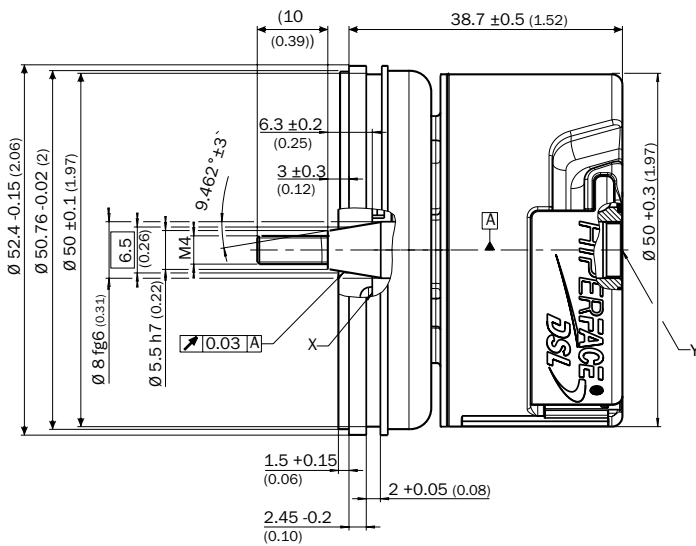- **Electrical interface:** HIPERFACE DSL®

Torque support	Type	Part no.
Spring mounting plate	EFM50-2KF0A021A	1073488
	EFM50-2KF0A023A	1073504
Resolver support	EFM50-2KF0A121A	1073496
	EFM50-2KF0A123A	1073512

Dimensional drawings (dimensions in mm (inch))
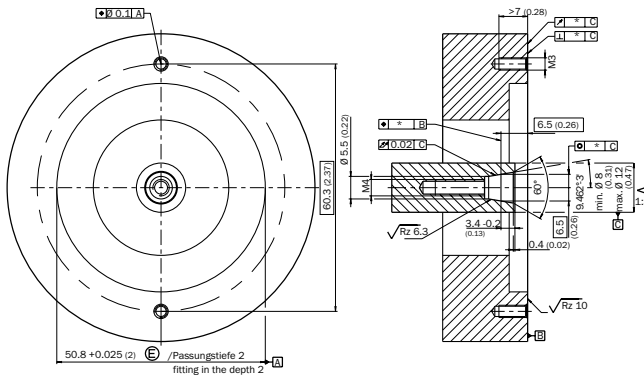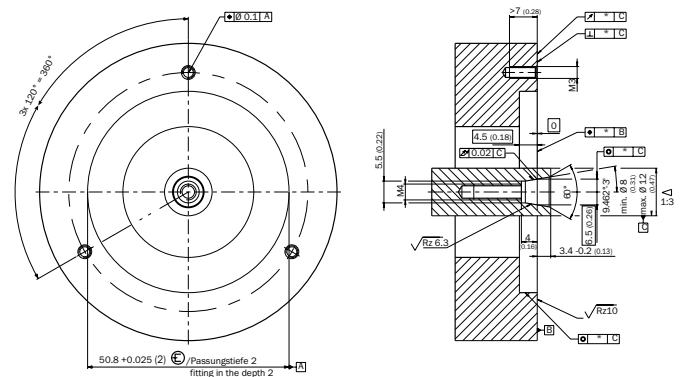
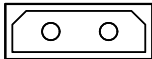### Spring mounting plate

Resolver support

Proposed fitting

with spring mounting plate

with resolver support

Pin assignment temperature sensor

PIN	Signal	Explanation
1	T+	Thermistor connection
2	T−	Thermistor connection (ground)

Recommended outer Ø for set of stranded wires: 2.2 mm ± 0.1 mm
Recommended mating plug: Harwin M80-8990205

Pin assignment supply/communication

PIN	Signal	Explanation
1		Not connected
2	+U$_S$/DSL+	7 … 12 V supply
3	GND/DSL−	Ground
4		Not connected

Recommended outer Ø for set of stranded wires: 2.8 mm +/-0.3 mm
Recommended mating plug: JST (GHR-04V-S)

Supported resources for HIPERFACE DSL®

Resource index	Function	Size (max. offset)	Read access	Write access	Designation
000h	Root node		0	-	ROOT
001h	Designation node		0	-	IDENT
002h	Monitoring node		0	-	MONITOR
003h	Administration node		0	-	ADMIN
004h	Counter node		0	-	COUNTER
005h	Data storage node		0	-	DATA
006h	Sensor hub nodes		0	-	SENSHUB
080h	Type of encoder	2	0	-	ENCTYPE
081h	Resolution	4	0	-	RESOLUTN
082h	Range	4	0	-	RANGE
083h	Type code designation	18	0	-	TYPECODE
084h	Serial number	10	0	-	SERIALNO
085h	Firmware version number	20	0	-	FWREVNO
086h	Firmware date	8	0	-	FWDATE
087h	EEPROM size	2	0	-	EESIZE
0C0h	Temperature range	4	0	-	TEMPRNG
0C1h	Temperature	2	0	-	TEMPRTUR
0C2h	LED current range	4	0	-	LEDRANGE
0C3h	LED current	2	0	-	LEDCURR
0C4h	Supply voltage range	4	0	-	SUPRANGE
0C5h	Supply voltage	2	0	-	SUPVOLT
0C6h	Speed range	2	0	-	SPEEDRNG
0C7h	Speed	2	0	-	SPEED
0C8h	Acceleration range	2	0	-	ACCRANGE
0CBh	Service life	8	0	-	LIFETIME
0CCh	Error log	8	0	-	ERRORLOG
0CDh	Usage histogram	4	0	-	HISTOGRM
100h	Reset	0	-	0	RESET
101h	Determine position	8	-	2	SETPOS
104h	Determine access level	8	0	0	SETACCCES
105h	Change access key	8	-	0	CHNGEKEY
107h	Warning limits	8	0	2	UWARNING
108h	Reset to the factory setting	8	-	2	FACRESET
109h	User-defined encoder index	2	0	3	ENCIDENT
10Ah	Position filter setting	4	0	3	POSFILT
120h	Read counter	4	0	-	READCNT
121h	Increment counter, service life: max. 300,000 increments	0	-	0	INCCOUNT
122h	Reset the counter	0	-	2	RESETCNT
130h	Load file	8	-	0	LOADFILE
131h	Access file	File size	User-defined	User-defined	RWFILE
132h	File status	4	-	-	FILESTAT
133h	Create/delete/change file	8	-	User-defined	MAKEFILE
134h	Directory	8	0	-	DIR
200h	I/O access	4	0	0	ACCESSIO
201h	Manage I/O	4	0	2	MANAGEIO

Supported access levels

Access level	User	Standard access key
0	Execute (default setting)	– (no key required)
1	Operator	1111 (31 31 31 31h)
2	Maintenance	2222 (32 32 32 32h)
3	Authorized client	3333 (33 33 33 33h)
4	User service	4444 (34 34 34 34h)

Overview of warnings and error indications

Error type	Error register	Error bit	Description
Position (incremental)	00h	0	A protocol reset was executed
	00h	1	Acceleration overflow, invalid position
	00h	2	Test running
	00h	4	Internal error in angular tracking, invalid position
	00h	5	Internal error in vector length, invalid position
	00h	6	Internal error in position counter, invalid position
	00h	7	Internal error in position synchronization, invalid position
Position (absolute)	01h	0	Error in absolute position in a rotation
	01h	1	Error 1 in absolute position in several rotations
	01h	2	Error 2 in absolute position with several rotations
	01h	3	Error 3 in absolute position in several rotations
	01h	4	Position cross check error
Initialization	02h	0	Switch-on self-test undertaken (only safety variants)
	02h	1	Warning safety parameter: error could be rectified (only safety variants)
	02h	2	Error safety parameter: error cannot be rectified (only safety variants)
	02h	3	Error calibration data
	02h	4	Internal communications error 1
	02h	5	Internal communications error 2
	02h	6	Internal general error
Checking	03h	0	Critical temperature
	03h	1	Critical LED current
	03h	2	Critical supply voltage
	03h	3	Critical speed
	03h	4	Critical acceleration
	03h	5	Critical overflow
	03h	6	Internal monitoring error
Access to resources	04h	0	Invalid argument given during resource access procedure
	04h	1	Resource access refused due to incorrect access level
	04h	2	Internal error during resource access
	04h	3	Error when accessing a user file
User-defined warnings	07h	0	User-defined warning 0
	07h	1	User-defined warning 1
	07h	2	User-defined warning 2
	07h	3	User-defined warning 3

Accessories

Plug connectors and cables

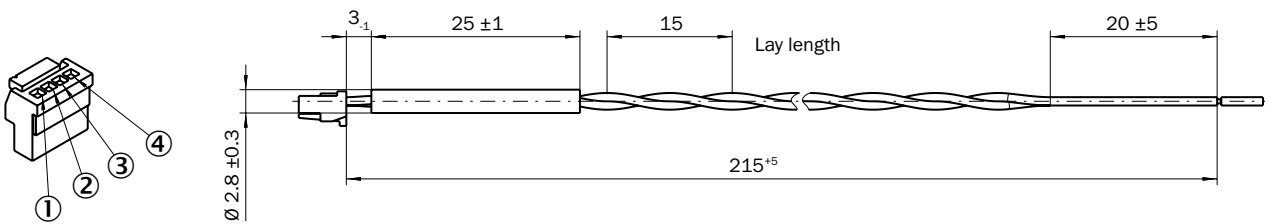| Brief description	Type	Part no.
Head A: female connector, braided, 2-pin, straight, for axial and radial outflows Head B: cable Cable: HIPERFACE DSL®, unshielded, 0.2 m	DOL-0B02-G0M2XC2	2079920

Other mounting accessories

Servo clamps

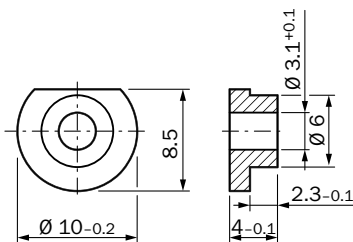| Figure	Brief description	Type	Part no.
	Servo clamps, small, for servo flange (clamps, eccentric fastener), 3 pcs., without mounting material	BEF-WK-RESOL	2039082

Dimensional drawing, accessories

DOL-0B02-G0M2XC2

PIN	Color
1	
2	gray
3	green
4	

BEF-WK-RESOL

PGT-11-S: The universal visualization and programming tool

There was a very clear motivation behind the development of the innovative sVip®: We wanted a single programming tool which supported all existing and future motor feedback systems. By developing this 'one-for-all' tool, we managed to achieve just that. sVip® is ideal for use with our systems and replaces all previous programming tools.

The sVip® supplements the familiar functions of predecessor programming tools by offering additional and improved applications for programming and analysis. What's more, the sVip® has a single standard user interface for all tasks.

- Oscilloscope function – for qualitative signal analysis
- Presentation of histograms, e.g., temperature
- Reading out and saving of E^{2}PROM content
- Enables synchronization of analog signals and the absolute position of HIPERFACE® products.

You can find more information in document 8017195.

Ordering information

Description	Part no.
PGT-11-S LAN sVip®	1057324
PGT-11-S WLAN sVip®	1067474

Scope of delivery

Power supply unit	100–240 V AC/12 V DC
Primary adapter	Europe, UK, USA/Japan, Australia
Ethernet cable	3 m in length

Note: The corresponding accessory leads for the connection of the motor feedback systems must be ordered separately.

sVip® accessory cables
Accessory cables for connecting the motor feedback system

HIPERFACE DSL®			
Figure	**Brief description**	**Type**	**Part no.**
	Female connector, M12, 4-pin, straight HIPERFACE DSL® cable, shielded, female connector, JST, 4-pin	DSL-1202-G01MA	2061361

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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.

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