Standard
SIL3/PLe, optical

Sendix SIL 5853FS3 / 5873FS3 (shaft / hollow shaft)

SSI / BiSS + SinCos

The absolute singleturn encoders 5853FS3 and 5873FS3 of the Sendix SIL family are suited for use in safety-related applications up to SIL3 according to EN 61800-5-2 or PLe to EN ISO 13849-1.

The extra strong Safety-Lock™ Design interlocked bearings, the high integration density of the components based on OptoASIC technology and the rugged die-cast housing make these devices ideal also for demanding applications outdoors up to IP65.

Safety-Lock™ | High rotational speed | Temperature range | High protection level | High shaft load capacity | Shock / vibration resistant | Magnetic field proof | Reverse polarity protection | SinCos | Optical sensor

Functional Safety

- Encoder with individual certificate from IFA / TÜV.
- Suitable for applications up to SIL3 acc. to EN 61800-5-2.
- Suitable for applications up to PLe acc. to EN ISO 13849-1.
- SSI or BiSS interface with incremental SinCos tracks with 2048 ppr.
- Certified mechanical mounting + electronic.

Flexible

- Shaft and hollow shaft versions.
- Cable and connector variants.
- Various mounting options available.

Order code Shaft version

8.5853FS3	.	1	X	X	X	.	X	X	2	X
Type		a	b	c	d		e	f		g

If for each parameter of an encoder the **underlined preferred option** is selected, then the delivery time will be 10 working days for a maximum of 10 pieces. Qts. up to 50 pcs. of these types generally have a delivery time of 15 working days.

10 by 10

a *Flange*
1 = clamping flange, IP65, ø 58 mm [2.28"]

b *Shaft (ø x L)*
2 = 10 x 20 mm [0.39 x 0.79"], with flat
A = 10 x 20 mm [0.39 x 0.79"], with feather key

c *Interface / power supply*
3 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC
4 = SSI, BiSS + 2048 ppr. SinCos / 10 ... 30 V DC

d *Type of connection*
1 = axial cable, 1 m [3.28'] PVC
A = axial cable, special length PVC *)
2 = radial cable, 1 m [3.28'] PVC
B = radial cable, special length PVC *)
3 = axial M23 connector, 12-pin
4 = radial M23 connector, 12-pin

*) Available special lengths (connection types A, B):
2, 3, 5, 8, 10, 15 m [5.56, 9.84, 16.40, 26.25, 32.80, 49.21']
order code expansion .XXXX = length in dm
ex.: 8.5853FS3.124A.G322.0030 (for cable length 3 m)

e *Code*
B = SSI, binary
C = BiSS, binary
G = SSI, gray

f *Resolution* [1]
A = 10 bit
1 = 11 bit
2 = 12 bit
3 = 13 bit
4 = 14 bit
7 = 17 bit

g *Options (service)*
1 = no option
2 = status LED
3 = SET button and status LED

Optional on request
- Ex 2/22 [2]
- other resolutions

1) Resolution, preset value and count direction are factory-programmable.
2) For the cable connection type, cable material PUR.

Absolute encoders - singleturn

Standard
SIL3/PLe, optical

Sendix SIL 5853FS3 / 5873FS3 (shaft / hollow shaft)

SSI / BiSS + SinCos

Order code Hollow shaft

8.5873FS3	.	X	X	X	X	.	X	X	2	X
Type		a	b	c	d		e	f		g

If for each parameter of an encoder the **underlined preferred option** is selected, then the delivery time will be 10 working days for a maximum of 10 pieces. Qts. up to 50 pcs. of these types generally have a delivery time of 15 working days.

10 by 10

a *Flange*
9 = with torque stop, flexible, IP65
A = with torque stop set, rigid, IP65
B = with stator coupling, IP65, ø 63 mm [2.48"]

b *Through hollow shaft*
3 = ø 10 mm [0.39"]
4 = ø 12 mm [0.47"]
5 = ø 14 mm [0.55"]
Tapered shaft
K = ø 10 mm [0.39"]

c *Interface / power supply*
3 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC
4 = SSI, BiSS + 2048 ppr. SinCos / 10 ... 30 V DC

d *Type of connection*
2 = radial cable, 1 m [3.28'] PVC
B = radial cable, special length PVC *)
E = tangential cable, 1 m [3.28'] PVC
F = tangential cable, special length PVC *)
4 = radial M23 connector, 12-pin

*) Available special lengths (connection types B, F):
2, 3, 5, 8, 10, 15 m [5.56, 9.84, 16.40, 26.25, 32.80, 49.21']
order code expansion .XXXX = length in dm
ex.: 8.5873FS3.B44B.G322.0030 (for cable length 3 m)

e *Code*
B = SSI, binary
C = BiSS, binary
G = SSI, gray

f *Resolution* [1]
A = 10 bit
1 = 11 bit
2 = 12 bit
3 = 13 bit
4 = 14 bit
7 = 17 bit

g *Options (service)*
1 = no option
2 = status LED
3 = SET button and status LED

Optional on request
- Ex 2/22 (not for type of connection E, F) [2]
- other resolutions

Accessories		Order no.
EMC shield terminal	for top-hat rail mounting	**8.0000.4G06.0000**
Screw retention	Loctite 243, 5 ml	**8.0000.4G05.0000**
Bellows coupling, safety-oriented	You will find an overview of our couplings for Sendix SIL shaft encoders in the accessories section or under www.kuebler.com/accessories.	
Safety modules Safety-M compact / modular	You will find an overview of our systems and components for Functional Safety and the corresponding software in the safety technology section or under www.kuebler.com/safety.	
LED SSI display 570 / 575	Electronic position display up to 32 bit. You will find an overview in the accessories section or under www.kuebler.com/position_display.	

Further accessories can be found in the accessories section or in the accessories area of our website at: www.kuebler.com/accessories.

Connection technology		Order no.
Cordset, pre-assembled	M23 female connector with coupling nut, 12-pin single-ended, 2 m [6.56'] PVC cable [3]	**8.0000.6901.0002.0031**
	M23 female connector with coupling nut, 12-pin M23 male connector with external thread, 12-pin 2 m [6.56'] PVC cable [3]	**8.0000.6905.0002.0032**
Connector, self-assembly (straight)	M23 female connector with coupling nut, 12-pin	**8.0000.5012.0000**

Additional connectors can be found in the connection technology section or in the connection technology area of our website at: www.kuebler.com/connection_technology.

1) Resolution, preset value and count direction are factory-programmable.
2) For the cable connection type, cable material PUR.
3) Other lengths available.

Standard
SIL3/PLe, optical | **Sendix SIL 5853FS3 / 5873FS3 (shaft / hollow shaft)** | **SSI / BiSS + SinCos**

Technical data

Notes regarding "Functional Safety"

These encoders are suitable for use in safety-related systems up to SIL3 acc. to EN 61800-5-2 and PLe to EN ISO 13849-1 in conjunction with controllers or evaluation units, which possess the necessary functionality.

Additional functions can be found in the operating manual.

Safety characteristics

Classification	PLe / SIL3
System structure	2 channel (Cat. 4)
PFH_d value [1]	1.09 x 10^{-8} h^{-1}
Mission time / Proof test interval	20 years
Relevant standards	EN ISO 13849-1:2008 EN ISO 13849-2:2013 EN 61800-5-2:2007

Electrical characteristics

Power supply		5 V DC (±5 %) or 10 ... 30 V DC
Current consumption (no load)	5 V DC	max. 70 mA
	10 ... 30 V DC	max. 45 mA
Reverse polarity protection of the power supply		yes
Short circuit proof outputs		yes [2]
UL approval		file 224618
CE compliant acc. to		EMC guideline 2014/30/EU Machinery directive 2006/42/EC RoHS guideline 2011/65/EU

Mechanical characteristics

Maximum speed shaft version		
	up to 70°C [158°F]	12000 min^{-1}, 10000 min^{-1} (continuous)
	up to T_{max}	8000 min^{-1}, 5000 min^{-1} (continuous)
Maximum speed hollow shaft version		
	up to 70°C [158°F]	9000 min^{-1}, 6000 min^{-1} (continuous)
	up to T_{max}	6000 min^{-1}, 3000 min^{-1} (continuous)
Starting torque - at 20°C [68°F]		
	shaft version	< 0.01 Nm
	hollow shaft version	< 0.03 Nm
Mass moment of inertia		
	shaft version	4.0 x 10^{-6} kgm^2
	hollow shaft version	7.0 x 10^{-6} kgm^2
Insertion depth for shaft		
	hollow shaft version	min. 34 mm [1.34"]
Load capacity of shaft	radial	80 N
	axial	40 N
Weight		approx. 0.45 kg [15.87 oz]
Protection acc. to EN 60529		IP65
Working temperature range		-40°C ... +90°C [-40°F ... +194°F] [3]
Material	shaft / hollow shaft	stainless steel
	flange	aluminum
	housing	zinc die-cast
	cable	PVC (PUR for Ex 2/22)
Shock resistance acc. to EN 60068-2-27		500 m/s^2, 11 ms
Vibration resistance acc. to EN 60068-2-6		200 m/s^2, 10 ... 150 Hz

EMC

Relevant standards	EN 55011 class B :2009 / A1:2010 EN 61000-6-3:2007 / A1:2011 EN 61000-6-2:2005

SSI interface

Output driver		RS485 transceiver type
Permissible load / channel		max. +/- 20 mA
Signal level	HIGH	typ. 3.8 V
	LOW at I_{Load} = 20 mA	typ. 1.3 V
Resolution		10 ... 14 bit and 17 bit
Code		binary or gray
SSI clock rate		50 kHz ... 2 MHz
Data refresh rate	ST resolution ≤ 14 bit	≤ 1 µs
	ST resolution ≥ 15 bit	4 µs
Monoflop time		≤ 15 µs

Note: If the clock starts cycling within the monoflop time, a second data transfer starts with the same data. If the clock starts cycling after the monoflop time, the data transfer starts with the new values. The update rate is dependent on the clock speed, data length and monoflop-time.

BiSS interface

Resolution		10 ... 14 bit and 17 bit
Code		binary
Clock rate		up to 10 MHz
Max. update rate		< 10 µs, depends on the clock rate and the data length
Data refresh rate	ST resolution ≤ 14 bit	≤ 1 µs
	ST resolution 17 bit	2.4 µs

Note:
- bidirectional, factory programmable parameters are: resolution, code, direction, alarms and warnings
- CRC data verification

SinCos interface

Max. frequency -3dB	400 kHz
Signal level	1 Vpp (±10 %)
Short circuit proof	yes [2]
Pulse rate	2048 ppr

LED

The optional LED (red) serves to display various alarm or error messages.
In normal operation the LED is OFF.

If the LED is ON (status output LOW) this indicates:
- sensor error, singleturn or multiturn (soiling, glass breakage etc.)
- LED error, failure or ageing
- Over- or under-temperature

In the SSI mode, the fault indication can only be reset by switching off the power supply to the device.

1) The specified value is based on a diagnostic coverage of 99 %, that must be achieved with an encoder evaluation unit.
The encoder evaluation unit must meet at least the requirements for SIL3.

2) Short circuit to 0 V or to output, one channel at a time, power supply correctly applied.
3) Cable version: -30°C ... +90°C [-22°F ... +194°F].

Absolute encoders - singleturn

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SSI / BiSS + SinCos

SET input or SET button

Input		HIGH active
Input type		comparator
Signal level	HIGH LOW	min: 60 % of +V, max: +V max: 25 % of +V (power supply)
Input current		< 0.5 mA
Min. pulse duration (SET)		10 ms
Timeout after SET signal		14 ms

The encoder can be set to zero at any position by means of a HIGH signal on the SET input or by pressing the optional SET button (with a pencil, ball-point pen or similar). Other preset values can be factory-programmed.
The SET input has a signal delay time of approx. 1 ms. Once the SET function has been triggered, the encoder requires an internal processing time of approx. 15 ms before the new position data can be read. During this time the LED is ON.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

DIR input

Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This function can also be factory-programmed to be inverted. If DIR is changed when the device is already switched on, then this will be interpreted as an error.
The LED will come ON and the status output will switch to LOW.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

Response time (DIR input) 1 ms

Power-ON

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

Hot plugging of the encoder should be avoided.

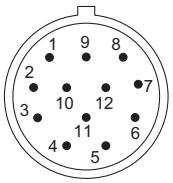
Terminal assignment

Interface	Type of connection	Cable (isolate unused wires individually before initial start-up)													
3, 4	1, 2, A, B, E, F	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	A	$\overline{A}$	B	$\overline{B}$	⏚
		Cable color:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU	shield

Interface	Type of connection	M23 connector, 12-pin													
3, 4	3, 4	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	A	$\overline{A}$	B	$\overline{B}$	⏚
		Pin:	1	2	3	4	5	6	7	8	9	10	11	12	PH

+V: Encoder power supply +V DC
0 V: Encoder power supply ground GND (0 V)
C+, C-: Clock signal
D+, D-: Data signal
SET: Set input
DIR: Direction input
A, $\overline{A}$: Cosine signal
B, $\overline{B}$: Sine signal
PH ⏚: Plug connector housing (shield)

Top view of mating side, male contact base



M23 connector, 12-pin

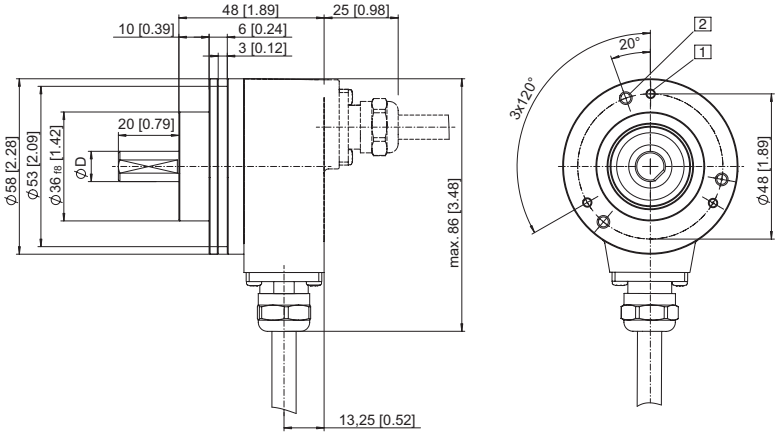
Standard
SIL3/PLe, optical | **Sendix SIL 5853FS3 / 5873FS3 (shaft / hollow shaft)** | **SSI / BiSS + SinCos**

Dimensions shaft version

Dimensions in mm [inch]

Clamping flange, ø 58 [2.28]
Flange type 1 with shaft type 2
(drawing with cable)

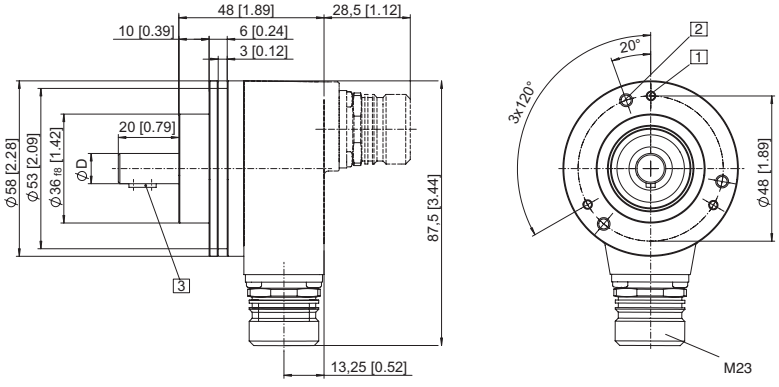
1 3 x M3, 6 [0.24] deep
2 3 x M4, 8 [0.32] deep



D	Fit	L
10 [0.39]	f7	20 [0.79]

Clamping flange, ø 58 [2.28]
Flange type 1 with shaft type A
(drawing with M23 connector)

1 3 x M3, 6 [0.24] deep
2 3 x M4, 8 [0.32] deep
3 Feather key DIN 6885 - A - 3x3x6



D	Fit	L
10 [0.39]	f7	20 [0.79]

Standard
SIL3/PLe, optical

Sendix SIL 5853FS3 / 5873FS3 (shaft / hollow shaft)

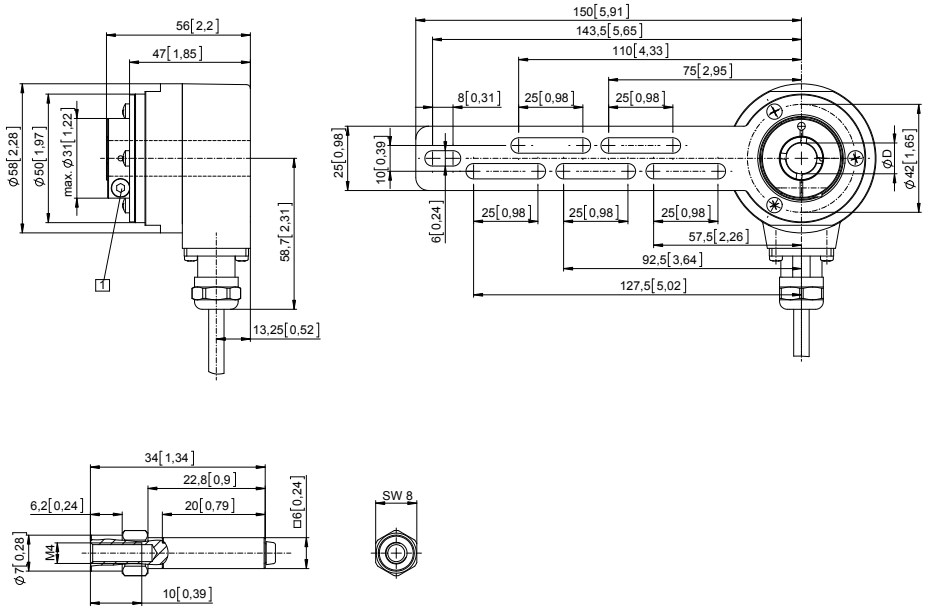
SSI / BiSS + SinCos

Dimensions hollow shaft version

Dimensions in mm [inch]

Flange with torque stop set, rigid
Flange type A
Through hollow shaft
(drawing with cable)

1 SW 3, recommended torque for the clamping ring 2.5 Nm

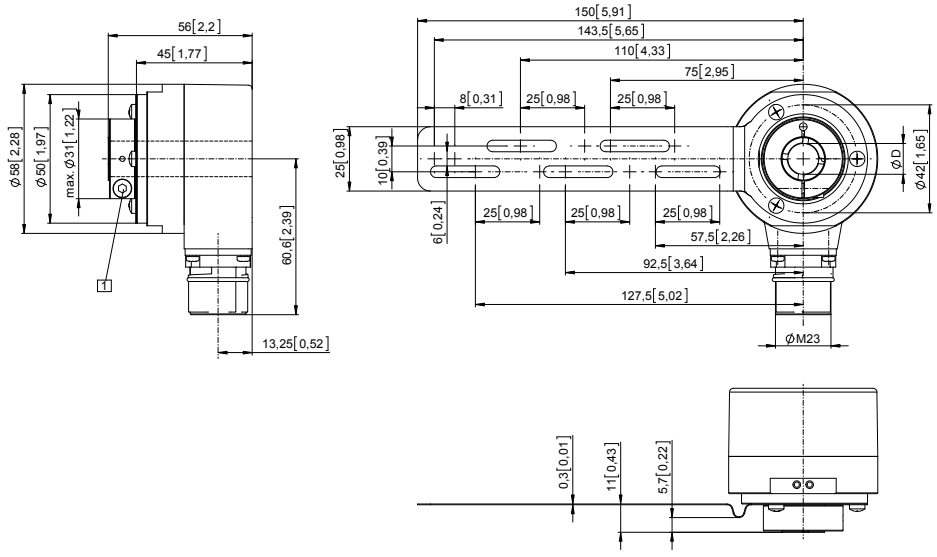


D	Fit
10 [0.39]	H7
12 [0.47]	H7
14 [0.55]	H7

Torque pin with rectangular sleeve with M4 thread

Flange with torque stop, flexible
Flange type 9
Through hollow shaft
(drawing with M23 connector)

1 Recommended torque for the clamping ring 2.5 Nm



D	Fit
10 [0.39]	H7
12 [0.47]	H7
14 [0.55]	H7

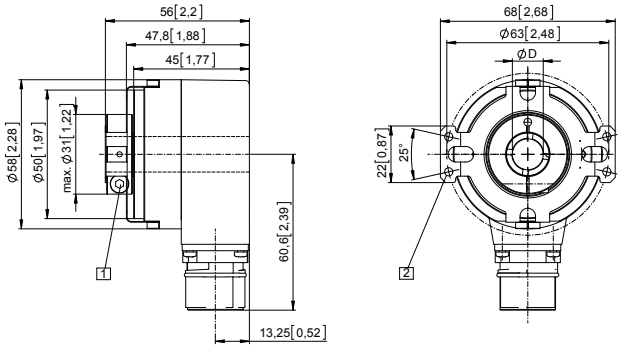
Standard
SIL3/PLe, optical | **Sendix SIL 5853FS3 / 5873FS3 (shaft / hollow shaft)** | **SSI / BiSS + SinCos**

Dimensions hollow shaft version

Dimensions in mm [inch]

Flange with stator coupling, ø 63 [2.48]
Flange type B
Through hollow shaft
(drawing with M23 connector)

1 SW 3, recommended torque for the clamping ring 2.5 Nm
2 For (4x) M3 screw



D	Fit
10 [0.39]	H7
12 [0.47]	H7
14 [0.55]	H7

Flange with stator coupling, ø 63 [2.48]
Flange type B
Tapered shaft
(drawing with tangential cable outlet)

1 For (4x) M3 screw
2 Status LED
3 SET button
4 SW 4