

Absolute encoders – multiturn

Standard
SIL2/PLd, mech. multiturn, optical

Sendix 5863FS2 / 5883FS2 (shaft / hollow shaft)

SSI/BiSS + SinCos



SIL2
 Functional Safety
PLd

The absolute multiturn encoders 5863FS2 and 5883FS2 of the Sendix family are suited for use in safety-related applications up to SIL2 according to EN 61800-5-2 or PLd 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 IP67.



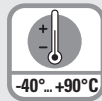
Mechanical drive



Safety-Lock™



High rotational speed



Temperature range
 -40° ... +90°C



High protection level
 IP



High shaft load capacity



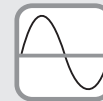
Shock / vibration resistant



Magnetic field proof



Reverse polarity protection



SinCos



Optical sensor

Functional Safety

- Encoder with individual certificate from TÜV.
- Suitable for applications up to SIL2 acc. to EN 61800-5-2.
- Suitable for applications up to PLd 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

8.5863FS2

Type

. **X X X X** . **X X 2 X**
 a b c d e f g

a Flange

- 1 = clamping flange, IP65, ø 58 mm [2.28"]
- 3 = clamping flange, IP67, 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 / supply voltage

- 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.: 8.5863FS2.124A.G322.0030 (for cable length 3 m)

e Code

- B = SSI, binary
- C = BiSS, binary
- G = SSI, gray

f Resolution ¹⁾

- A = 10 bit ST + 12 bit MT
- 1 = 11 bit ST + 12 bit MT
- 2 = 12 bit ST + 12 bit MT
- 3 = 13 bit ST + 12 bit MT
- 4 = 14 bit ST + 12 bit MT
- 7 = 17 bit ST + 12 bit MT

g Options (service)

- 1 = no option
- 2 = status LED
- 3 = SET button and status LED

Optional on request

- Ex 2/22 ²⁾
- other resolutions
- surface protection salt spray

1) Resolution, preset value and count direction are factory-programmable.

2) For the cable connection type, cable material PUR.

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Order code Hollow shaft	8.5883FS2 Type	. XXXXX . XX2X a b c d e f g
a Flange 9 = with torque stop FS, flexible, IP65 J = with torque stop FS, flexible, IP67 A = with torque stop FS, rigid, IP65 (incl. torque pin FS) K = with torque stop FS, rigid, IP67 (incl. torque pin FS) B = with stator coupling FS, ø 63 mm [2.48"], IP65 L = with stator coupling FS, ø 63 mm [2.48"], IP67 b Through hollow shaft 3 = ø 10 mm [0.39"] 4 = ø 12 mm [0.47"] 5 = ø 14 mm [0.55"] <i>Tapered shaft</i> K = ø 10 mm [0.39"] c Interface / supply voltage 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.: 8.5883FS2.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 ST + 12 bit MT 1 = 11 bit ST + 12 bit MT 2 = 12 bit ST + 12 bit MT 3 = 13 bit ST + 12 bit MT 4 = 14 bit ST + 12 bit MT 7 = 17 bit ST + 12 bit MT g Options (service) 1 = no option 2 = status LED 3 = SET button and status LED <i>Optional on request</i> - Ex 2/22 (not for type of connection E, F) ^{2) 3)} - other resolutions - surface protection salt spray ³⁾		

Accessories		Order no.
EMC shield terminal	for top-hat rail mounting	8.0000.4G06.0312
Screw retention	Loctite 243, 5 ml	8.0000.4G05.0000
Bellows coupling, safety-oriented	You will find an overview of our couplings for Sendix shaft encoders under kuebler.com/accessories .	
Safety modules Safety-M compact	You will find an overview of our systems and components for Functional Safety and the corresponding software under kuebler.com/safety .	
LED SSI display 570 / 575	Electronic position display up to 32 bit. You will find an overview or under kuebler.com/position_display	

Cables and connectors		Order no.
Preassembled cables	M23 female connector with coupling nut, 12-pin, cw single ended 2 m [6.56"] PVC cable ⁴⁾	8.0000.6901.0002.0031
	M23 female connector with coupling nut, 12-pin, cw M23 male connector with external thread, 12-pin, ccw 2 m [6.56"] PVC cable ⁴⁾	8.0000.6905.0002.0032
Connectors	M23 female connector with coupling nut, 12-pin, cw	8.0000.5012.0000

Further Kübler accessories can be found at: kuebler.com/accessories
 Further Kübler cables and connectors can be found at: kuebler.com/connection-technology

1) Resolution, preset value and count direction are factory-programmable.
 2) For the cable connection type, cable material PUR.
 3) Not possible for flange type A and K.
 4) Other lengths available.

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Technical data

Notes regarding "Functional Safety"

These encoders are suitable for use in safety-related systems up to SIL2 acc. to EN 61800-5-2 and PLd 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	PLd / SIL2
System structure	2 channel (Cat. 3)
PFH_d value¹⁾	$2.16 \times 10^{-8} \text{ h}^{-1}$
Mission time / Proof test interval	20 years
Relevant standards	EN ISO 13849-1:2015; EN ISO 13849-2:2012; EN 61800-5-2:2007

Electrical characteristics

Supply voltage	5 V DC ($\pm 5\%$) or 10 ... 30 V DC
Current consumption (no load)	5 V DC max. 80 mA 10 ... 30 V DC max. 50 mA
Reverse polarity protection of the supply voltage	yes
Short circuit proof outputs	yes ²⁾

Mechanical characteristics

Maximum speed shaft version up to 70 °C [158 °F] up to T _{max}	12000 min ⁻¹ , 10000 min ⁻¹ (continuous) 8000 min ⁻¹ , 5000 min ⁻¹ (continuous)
Maximum speed hollow shaft version up to 70 °C [158 °F] up to T _{max}	9000 min ⁻¹ , 6000 min ⁻¹ (continuous) 6000 min ⁻¹ , 3000 min ⁻¹ (continuous)
Starting torque - at 20 °C [68 °F] shaft version hollow shaft version	< 0.01 Nm < 0.03 Nm
Mass moment of inertia shaft version hollow shaft version	$4.0 \times 10^{-6} \text{ kgm}^2$ $7.0 \times 10^{-6} \text{ kgm}^2$
Insertion depth for shaft hollow shaft version	min. 34 mm [1.34"]
Load capacity of shaft radial axial	80 N 40 N
Weight	approx. 0.45 kg [15.87 oz]
Protection acc. to EN 60529	IP65, IP67
Working temperature range	-40 °C ... +90 °C [-40 °F ... +194 °F] ³⁾
Material shaft / hollow shaft flange housing cable	stainless steel aluminum zinc die-cast 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 , 5 ... 2000 Hz

EMC

Relevant standards	EN 55011 class B :2009 / A1:2010 EN 61326-1:2013 EN 61326-3-1:2008
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SSI interface

Output driver	RS485 transceiver type
Permissible load / channel	max. $\pm 20 \text{ mA}$
Signal level HIGH LOW at I _{Load} = 20 mA	typ 3.8 V typ 1.3 V
Resolution singleturn	10 ... 14 bit and 17 bit
Number of revolutions (multiturn)	4096 (12 bit)
Code	binary or gray
SSI clock rate	50 kHz ... 2 MHz
Data refresh rate ST resolution ≤ 14 bit ST resolution ≥ 15 bit	$\leq 1 \mu\text{s}$ 4 μs
Monoflop time	$\leq 15 \mu\text{s}$

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

Output driver	RS485 transceiver type
Permissible load / channel	max. $\pm 20 \text{ mA}$
Signal level HIGH LOW at I _{Load} = 20 mA	typ 3.8 V typ 1.3 V
Resolution singleturn	10 ... 14 bit and 17 bit
Number of revolutions (multiturn)	4096 (12 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 ST resolution 17 bit	$\leq 1 \mu\text{s}$ 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 V _{pp} ($\pm 10\%$)
Short circuit proof	yes ²⁾
Pulse rate	2048 ppr

1) The specified value is based on a diagnostic coverage of 90 %, that must be achieved with an encoder evaluation unit.

The encoder evaluation unit must meet at least the requirements for SIL2.

2) Short circuit to 0 V or to output, one channel at a time, supply voltage correctly applied.

3) Cable version: -30 °C ... +90 °C [-22 °F ... +194 °F].

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SET input or SET button	
Input	HIGH active
Input type	comparator
Signal level	HIGH min: 60 % of +V, max: +V LOW max: 25 % of +V (supply voltage)
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.	

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 supply voltage to the device.	

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.	
Reaction 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.	

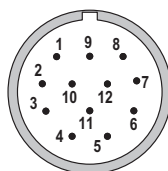
Approvals	
UL compliant in accordance with	File no. E224618
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
ATEX Directive	2014/34/EU (for Ex 2/22 variants)
Machinery Directive	2006/42/EG

Terminal assignment

Interface	Type of connection	Cable (isolate unused cores individually before initial start-up)													
3, 4	1, 2, A, B, E, F	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	A	$\bar{A}$	B	$\bar{B}$	$\perp$
		Core 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	$\bar{A}$	B	$\bar{B}$	$\perp$
		Pin:	1	2	3	4	5	6	7	8	9	10	11	12	PH

+V: Supply voltage encoder +V DC
0 V: Supply voltage encoder ground GND (0 V)
C+, C-: Clock signal
D+, D-: Data signal
SET: Set input
DIR: Direction input
A, $\bar{A}$: Cosine signal
B, $\bar{B}$: Sine signal
PH $\perp$: Plug connector housing (shield)

Top view of mating side, male contact base



M23 connector, 12-pin

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Dimensions shaft version

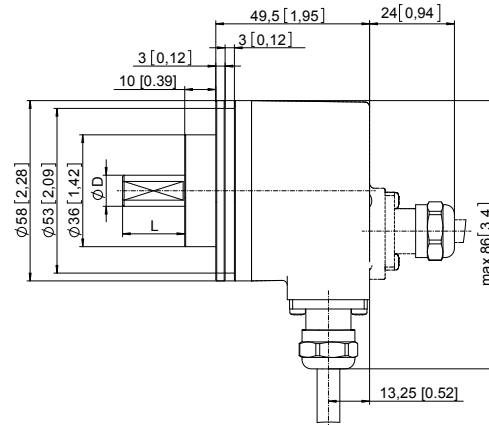
Dimensions in mm [inch]

Clamping flange, ø 58 [2.28]

Flange type 1 + 3 with shaft type 2

(drawing with cable)

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



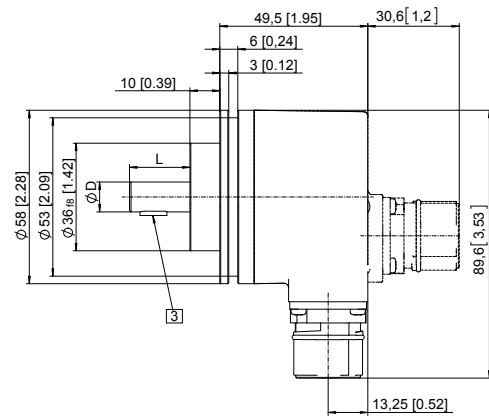
D	Fit	L
10 [0.39]	f7	20 [0.79]

Clamping flange, ø 58 [2.28]

Flange type 1 + 3 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]

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Dimensions hollow shaft version

Dimensions in mm [inch]

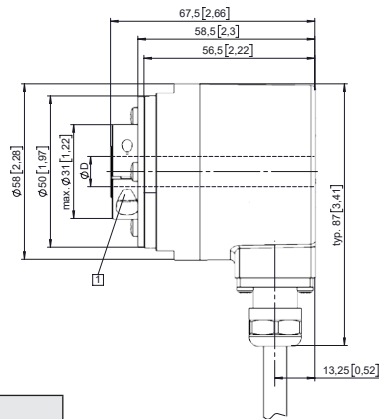
Flange with torque stop FS, rigid

Flange type A + K

Through hollow shaft

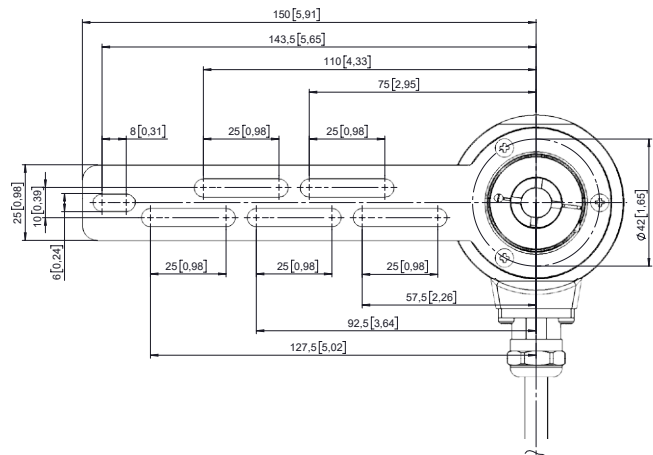
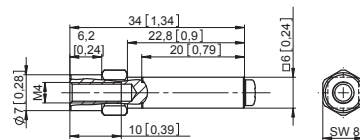
(drawing with cable)

- 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



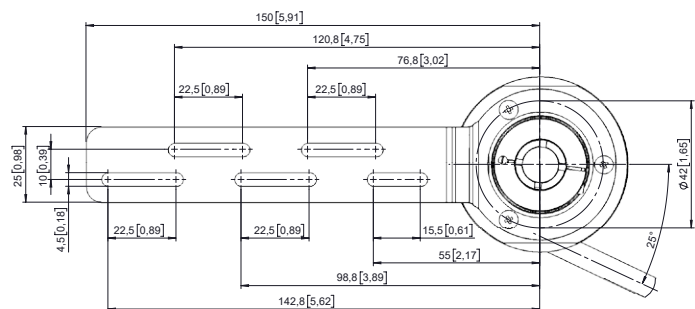
Flange with torque stop FS, flexible

Flange type 9 + J

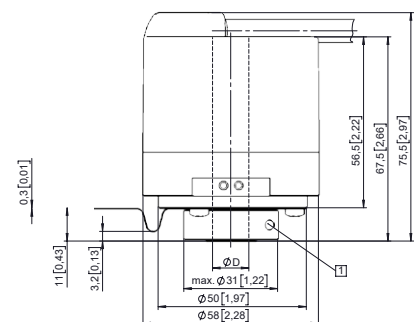
Through hollow shaft

(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



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Dimensions hollow shaft version

Dimensions in mm [inch]

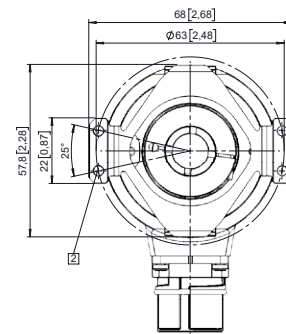
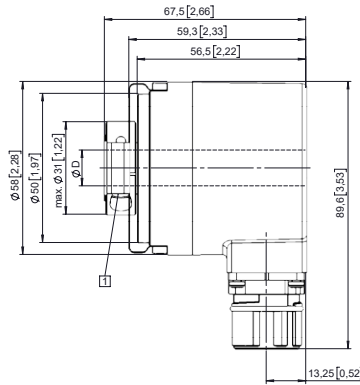
Flange with stator coupling FS, ø 63 [2.48]

Flange type B + L

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 FS, ø 63 [2.48]

Flange type B + L

Tapered shaft

(drawing with tangential cable outlet)

- 1 For (4x) M3 screw
- 2 Status-LED
- 3 SET button
- 4 Recommended torque for central screw M5 (SW 4) 3.0 ^{+0.5} Nm (tapered shaft)

