

# Absolute Encoders – Multiturn

**Standard**  
SIL3/PLe, mech. Multiturn, optical

Sendix SIL 5863FS3 / 5883FS3 (Shaft / Hollow shaft) SSI/BiSS-C + SinCos



The absolute multiturn encoders 5863FS3 and 5883FS3 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 IP67.



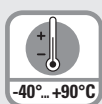
Mechanical drive



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 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-C 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

**8.5863FS3**

Type

**1** **X** **X** **X** **X** **X** **X** **X** **X** **X**

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.



### 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 or BiSS-C + 2048 ppr SinCos / 5 V DC**  
**4 = SSI or BiSS-C + 2048 ppr SinCos / 10 ... 30 V DC**

### d Type of connection

**1 = axial cable, 1 m [3.28'] PVC**  
**2 = radial cable, 1 m [3.28'] PVC**  
**3 = M23 connector, 12 pin, axial**  
**4 = M23 connector, 12 pin, radial**

### e Code

**B = SSI, Binary**  
**C = BiSS-C, Binary**  
**G = SSI, Gray**

### f Resolution <sup>1)</sup>

**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 Inputs / outputs <sup>1)</sup>

**2 = SET, DIR inputs**

### h Options (Service)

**1 = no option**  
**2 = Status LED**  
**3 = SET button and Status LED**

*optional on request*  
- special cable length  
- Ex 2/22

## Order code

**8.5883FS3**

Type

**X** **X** **X** **X** **X** **X** **X** **X** **X** **X**

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.



### a Flange

**A = with torque stop set, IP65**  
**B = with stator coupling, IP65, ø 63 mm [2.48"]**

### b Hollow shaft

**3 = ø 10 mm [0.39"]**  
**4 = ø 12 mm [0.47"]**  
**5 = ø 14 mm [0.55"]**  
**K = ø 10 mm [0.39"], tapered shaft**

### c Interface / Power supply

**3 = SSI or BiSS-C + 2048 ppr SinCos / 5 V DC**  
**4 = SSI or BiSS-C + 2048 ppr SinCos / 10 ... 30 V DC**

### d Type of connection

**2 = radial cable, 1 m [3.28'] PVC**  
**E = tangential cable, 1 m [3.28'] PVC**  
**4 = M23 connector, 12 pin, radial**

### e Code

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**C = BiSS-C, Binary**  
**G = SSI, Gray**

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*optional on request*  
- special cable length  
- Ex 2/22

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

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Standard SIL3/PLe, mech. Multiturn, optical		Sendix SIL 5863FS3 / 5883FS3 (Shaft / Hollow shaft)	SSI/BiSS-C + SinCos
Accessory safety technology			Order No.
Safety-M, basic modules	speed / position monitoring for 1 axis		8.MSP1.000
	speed / position monitoring for 2 axes (analogue inputs optional)		8.MSP2.XXX
Connection technology			
Connector, self-assembly (straight)	M23 female connector with coupling nut		8.0000.5012.0000
	M23 female connector with coupling nut, Ex zone 2/22		8.0000.5012.0000.Ex
Cordset, pre-assembled	M23 female connector with coupling nut, 2 m [2.19'] PVC cable		8.0000.6901.0002.0031

Further accessories can be found in the accessories section or in the accessories area of our website at: [www.kuebler.com/accessories](http://www.kuebler.com/accessories)  
 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](http://www.kuebler.com/connection_technology)  
 You will find an overview of our systems and components for functional safety under [www.kuebler.com/safety](http://www.kuebler.com/safety)

## 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		
Relevant standards	EN ISO 13849-1 / EN 61800-5-2, EN 61508	
Classification	PLe / SIL3	
System structure	2 channel (Cat. 4 / HFT = 1)	
PFH <sub>d</sub> value <sup>1)</sup>	1.09 x 10 <sup>-8</sup> h <sup>-1</sup>	
Proof-test interval	20 years	
Mechanical characteristics		
Max. speed, shaft version		
	up to 70°C [158°F]	12 000 min <sup>-1</sup> , 10 000 min <sup>-1</sup> (continuous)
	up to T <sub>max</sub>	8 000 min <sup>-1</sup> , 5 000 min <sup>-1</sup> (continuous)
Max. speed, hollow shaft version		
	up to 70°C [158°F]	9 000 min <sup>-1</sup> , 6 000 min <sup>-1</sup> (continuous)
	up to T <sub>max</sub>	6 000 min <sup>-1</sup> , 3 000 min <sup>-1</sup> (continuous)
Starting torque - at 20°C [68°F]		
	shaft version	< 0.01 Nm
	hollow shaft version	< 0.03 Nm
Moment of inertia		
	shaft version	4.0 x 10 <sup>-6</sup> kgm <sup>2</sup>
	hollow shaft version	7.0 x 10 <sup>-6</sup> kgm <sup>2</sup>
Load capacity of shaft		
	radial	80 N
	axial	40 N
Weight		
		approx. 0.45 kg [15.87 oz]
Protection acc. to EN 60529		
	housing side	IP67
	shaft side	IP65
Hazardous area approval		
		optional zone 2 and 22
Working temperature range		
		-40°C ... +90°C <sup>2)</sup> [-40°F ... +194°F] <sup>2)</sup>
Material		
	shaft / hollow shaft	stainless steel
	flange	aluminium
	housing	zinc die-cast housing
	cable	PVC
Shock resistance acc. EN 60068-2-27		
		500 m/s <sup>2</sup> , 11 ms
Vibration resistance acc. EN 60068-2-6		
		200 m/s <sup>2</sup> , 10 ... 150 Hz

Electrical characteristics		
Power supply		5 V DC ± 5% or 10 ... 30 V DC
Current consumption (no load)	5 V DC 10 ... 30 V DC	max. 80 mA max. 50 mA
Reverse polarity protection of the power supply (+V)		yes
Short circuit proof outputs		yes <sup>3)</sup>
UL approval		File 224618
CE compliant acc. to		EMC guideline 2004/108/EC Machinery directive 2006/42/EC
RoHS compliant acc. to		guideline 2002/95/EC

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

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

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SSI interface			
Output driver		RS485 transceiver type	
Permissible load / channel		max. 20 mA	
Signal level		HIGH	typ 3.8 V
		LOW at I <sub>Load</sub> = 20 mA	typ 1.3 V
Singleturn resolution		10 ... 14 bit and 17 bit <sup>1)</sup>	
Number of revolutions		4096 (12 bit)	
Code		Binary or Gray	
SSI clock rate	resolution ST ≤ 14 bit	50 kHz ... 2 MHz	
	resolution ST ≥ 15 bit	50 kHz ... 125 kHz	
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.			
Data refresh rate	resolution ST ≤ 14 bit	≤ 1 μs	
	resolution ST ≥ 15 bit	4 μs	
Status and parity bit		on request	

BiSS-C interface	
Singleturn resolution	10 ... 14 bit and 17 bit <sup>1)</sup>
Number of revolutions	4096 (12 bit)
Code	Binary
Clock rate	up to 10 MHz
Max. update rate	< 10 $\mu\text{s}$ , depends on the clock rate and the data length
Data refresh rate	$\leq 1 \mu\text{s}$
Note:	<ul style="list-style-type: none"> <li>– Bidirectional, factory programmable parameters are: resolution, code, direction, alarms and warnings</li> <li>– CRC data verification</li> </ul>

SinCos interface	
Max. frequency -3dB	400 kHz
Signal level	1 V <sub>pp</sub> ( $\pm 10\%$ )
Short circuit proof	yes
Pulse rate	2048 ppr

SET input or SET button		
Input	active HIGH	
Input type	comparator	
Signal level	HIGH	min: 60 % of +V, max: +V
	LOW	max: 25 % of +V (power supply)
Input current	< 0.5 mA	
Min. pulse duration (SET)	10 ms	
Timeout after SET signal	14 ms	
Reaction time (DIR input)	1 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.

DIR 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.	

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

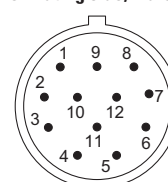
LED	
The optional LED (red) serves to display various alarm or error messages. In normal operation the LED is OFF.	
If the LED is ON this indicates:	
<ul style="list-style-type: none"> <li>- Sensor error, singleturn or multiturn (soiling, glass breakage etc.)</li> <li>- LED error, failure or ageing</li> <li>- Over- or under-temperature</li> </ul>	
In the SSI mode, the fault indication can only be reset by switching off the power-supply to the device.	

## Terminal assignment

Interface	Type of connection	Cable (isolate unused wires individually before initial start-up)													
3, 4	1, 2, E	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	A	$\bar{A}$	B	$\bar{B}$	$\perp$
		Cable colour:	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: 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. The current position becomes defined as position zero.
- DIR: Direction input: If this input is active, output values are counted backwards (decrease) when the shaft is turning clockwise.
- 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

1) Other options on request

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SSI/BiSS-C + SinCos

## Dimensions shaft version

Dimensions in mm [inch]

### Clamping flange, ø 58 [2.28]

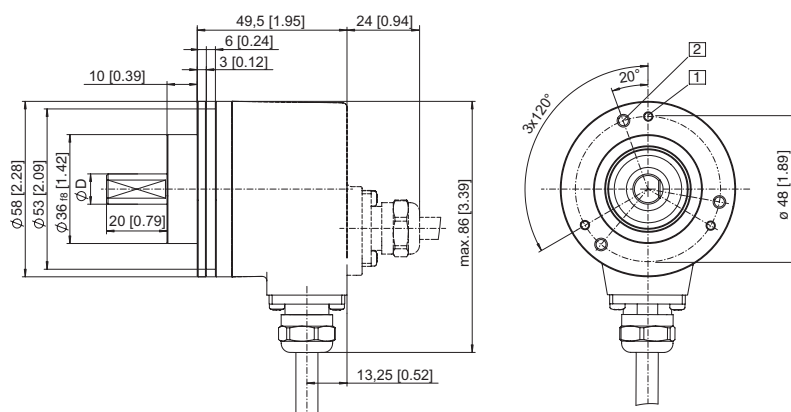
#### Flange type 1 with shaft type 2

(Drawing with cable)

1 3 x M3, 6 [0.24] deep

2 3 x M4, 8 [0.32] deep

D = 10 <sup>H7</sup> [0.39]



### Clamping flange, ø 58 [2.28]

#### Flange type 1 with shaft type A

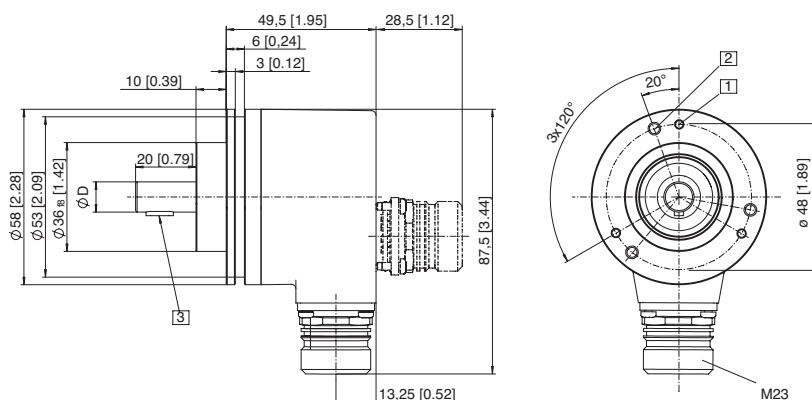
(Drawing with M23 connector)

1 3 x M3, 6 [0.24] deep

2 3 x M4, 8 [0.32] deep

3 Feather key DIN 6885 - A - 3x3x6

D = 10 <sup>H7</sup> [0.39]



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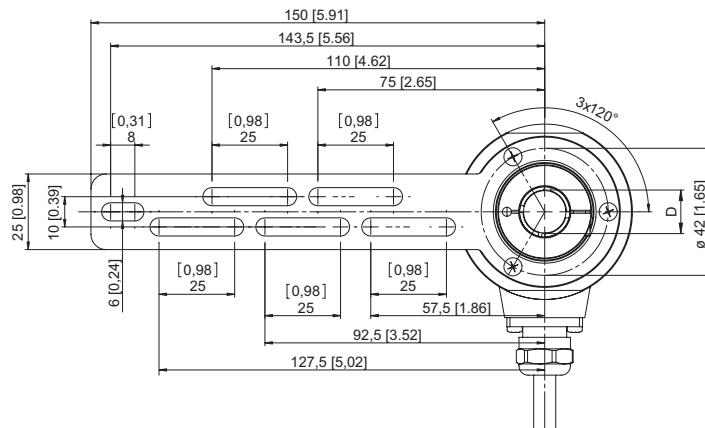
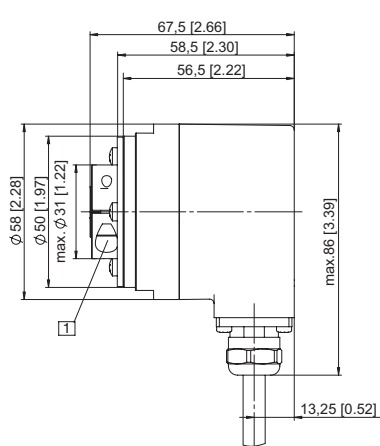
## Dimensions hollow shaft version

Dimensions in mm [inch]

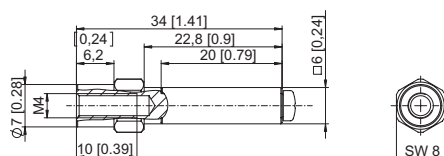
### Flange with torque stop set Flange type A (Drawing with cable)

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

D =  $\varnothing 10^{H7}$  [0.39]  
 $\varnothing 12^{H7}$  [0.47]  
 $\varnothing 14^{H7}$  [0.55]



Torque pin with rectangular sleeve with M4 thread, 10 [0.39] deep

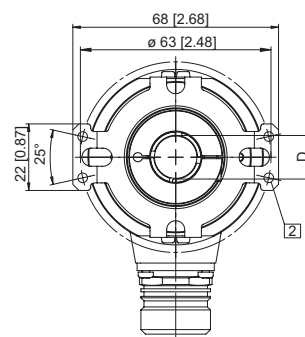
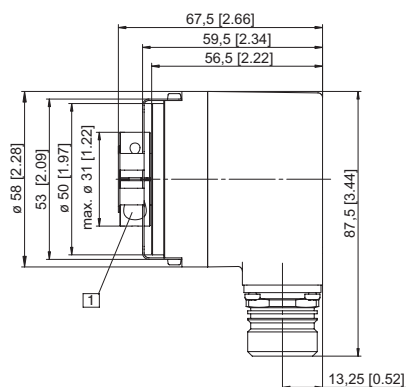


### Flange with stator coupling, $\varnothing 63$ [2.48] and hollow shaft Flange type B (Drawing with M23 connector)

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

- 2 for (4x) M3 screw

D =  $\varnothing 10^{H7}$  [0.39]  
 $\varnothing 12^{H7}$  [0.47]  
 $\varnothing 14^{H7}$  [0.55]



### Flange with stator coupling, $\varnothing 63$ [2.48] and tapered shaft Flange type B (Drawing with tangential cable outlet)

- 1 for (4x) M3 screw

- 2 Status LED

- 3 SET button

- 4 SW 4

