

Absolute Encoders - Singleturn

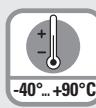
Compact
Optical

Sendix F3653 / F3673 (Shaft / Hollow shaft)

SSI / BiSS-C



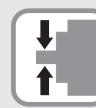
Safety-Lock™



Temperature range



High protection level



High shaft load capacity



Shock / vibration resistant



Magnetic field proof



Short-circuit proof



Reverse polarity protection



SinCos



Optical sensor



Seawater-resistant version on request

Reliable and magnetically insensitive

- Sturdy bearing construction in Safety-Lock™ Design for resistance against vibration and installation errors
- Ideal for use outdoors thanks to IP67 protection and wide temperature range from -40°C up to +90°C
- Patented Intelligent Scan Technology™ with all singleturn and multturn functions on one single OptoASIC - offering highest reliability, a high resolution up to 17 bits and 100% magnetic field insensitiveness

Optimised performance

- High-precision with a data refresh rate of the position value $\leq 1\mu\text{s}$
- High-resolution feedback in real-time via incremental outputs SinCos and RS422
- Short control cycles, clock rate with SSI up to 2 MHz / with BiSS-C up to 10 MHz

Order code
Shaft version

8.F3653 . XXX . XX12
Type a b c d e f

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, IP67, ø 36 mm [1.42"]
3 = clamping flange, IP65, ø 36 mm [1.42"]
2 = synchro flange, IP67, ø 36 mm [1.42"]
4 = synchro flange, IP65, ø 36 mm [1.42"]

c Interface / Power supply
1 = SSI or BiSS-C / 5 V DC
2 = SSI or BiSS-C / 10 ... 30 V DC
3 = SSI or BiSS-C + 2048 ppr SinCos / 5 V DC
4 = SSI or BiSS-C + 2048 ppr SinCos / 10 ... 30 V DC
5 = SSI or BiSS-C, with sensor output for monitoring the voltage on the encoder / 5 V DC
6 = SSI or BiSS-C + 2048 ppr SinCos, with sensor output for monitoring the voltage on the encoder / 5 V DC
7 = SSI or BiSS-C + 2048 ppr incr. signals RS422 / 5 V DC
8 = SSI or BiSS-C + 2048 ppr incr. signals RS422 / 10 ... 30 V DC

b Shaft (ø x L), with flat
1 = ø 6 x 12.5 mm [0.24 x 0.49"]
3 = ø 8 x 15 mm [0.32 x 0.59"]
5 = ø 10 x 20 mm [0.39 x 0.79"]
2 = ø 1/4" x 12.5 mm [0.49"]
4 = ø 3/8" x 5/8"

i Type of connection
1 = cable, tangential, 1 m [3.28] PUR
3 = cable tangential, 5 m [16.40] PUR
8 = M12 connector, 8-pin, axial¹⁾

e Code
B = SSI, Binary
C = BiSS-C, Binary
G = SSI, Gray

f Resolution
A = 10 bit ST
2 = 12 bit ST
3 = 13 bit ST
4 = 14 bit ST
7 = 17 bit ST

optional on request
- seawater-resistant
- special cable length

1) Only with output circuits 1 and 2

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Compact Optical	Sendix F3653 / F3673 (Shaft / Hollow shaft)	SSI / BiSS-C
Order code Hollow shaft	8.F3673 . X X X X . X X 12 Type a b c d . e f	If for each parameter of an encoder the <u>underlined preferred option</u> 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 = with spring element short, IP65 3 = with spring element long, IP65 2 = with stator coupling, IP65, ø 46 mm [1.81"]	c Interface / Power supply 1 = SSI or BiSS-C / 5 V DC 2 = SSI or BiSS-C / 10 ... 30 V DC 3 = SSI or BiSS-C + 2048 ppr SinCos / 5 V DC 4 = SSI or BiSS-C + 2048 ppr SinCos / 10 ... 30 V DC 5 = SSI or BiSS-C, with sensor output for monitoring the voltage on the encoder / 5 V DC 6 = SSI or BiSS-C + 2048 ppr SinCos, with sensor output for monitoring the voltage on the encoder / 5 V DC 7 = SSI or BiSS-C + 2048 ppr incr. signals RS422 / 5 V DC 8 = SSI or BiSS-C + 2048 ppr incr. signals RS422 / 10 ... 30 V DC	e Code B = SSI, Binary C = BiSS-C, Binary G = SSI, Gray
b Hollow shaft 1 = ø 6 mm [0.24"] 3 = ø 8 mm [0.32"] 4 = ø 10 mm [0.39"], blind hollow shaft 2 = ø 1/4"	d Type of connection 1 = cable, tangential, 1 m [3.28'] PUR 3 = cable tangential, 5 m [16.40'] PUR 8 = M12 connector, 8-pin, axial ¹⁾	f Resolution A = 10 bit ST 2 = 12 bit ST 3 = 13 bit ST 4 = 14 bit ST 7 = 17 bit ST
		optional on request - seawater-resistant - special cable length

Mounting accessory for shaft encoders	Order No.
Coupling	8.0000.1101.0606
Bellows coupling ø 19 mm [0.75"] for shaft 6 mm [0.24"]	
Mounting accessory for hollow shaft encoders	
Cylindrical pin, long for torque stops	8.0010.4700.0000
Connection technology	
Connector, self-assembly (straight)	05.CMB 8181-0
M12 female connector with coupling nut (suitable for connection type 8)	
Cordset, pre-assembled	05.00.6041.8211.002M
M12 female connector with coupling nut, 2 m [6.56'] PVC cable (suitable for connection type 8)	

Further accessories can be found in the accessories section or in the accessories area of our website at: 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

Technical data			
Mechanical characteristics			
Maximum speed			
Shaft- or blind hollow shaft version without shaft seal (IP65)		12 000 min ⁻¹ 10 000 min ⁻¹ (continuous)	
Shaft version (IP67) or hollow shaft version (IP65) with shaft seal		10 000 min ⁻¹ 8 000 min ⁻¹ (continuous)	
Starting torque at 20°C [68°F]	without shaft seal with shaft seal (IP67)	< 0.007 Nm < 0.01 Nm	
Load capacity of shaft	radial axial	40 N 20 N	
Weight		approx. 0.2 kg [7.06 oz]	
Protection acc. to EN 60529			
housing side	IP67	shaft side	IP65 (solid shaft version opt. IP67)
Working temperature range			
		-40°C ... +90°C [-40°F ... +194°F]	
Material	shaft / hollow shaft flange housing cable	stainless steel aluminium zinc die-cast PUR	
Shock resistance acc. to EN 60068-2-27			
		2500 m/s ² , 6 ms	
Vibration resistance acc. to EN 60068-2-6			
		100 m/s ² , 55 ... 2000 Hz	

1) Only with interfaces 1 and 2 in combination with blind hollow shaft 10 mm [0.39"]

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Compact Optical	Sendix F3653 / F3673 (Shaft / Hollow shaft)	SSI / BiSS-C		
Electrical characteristics				
Power supply	5 V DC \pm 5% or 10 ... 30 V DC			
Current consumption (no load)	5 V DC 10 ... 30 V DC	max. 60 mA max. 30 mA		
Reverse polarity protection of the power supply	yes (only with 10 ... 30 V DC)			
Short-circuit proof outputs	yes ¹⁾			
UL approval	File 224618			
CE compliant acc. to	EMC guideline 2004/108/EC			
RoHS compliant acc. to	guideline 2011/65/EU			
SSI interface				
Output driver	RS485 transceiver type			
Permissible load/channel	max. \pm 30 mA			
Signal level	HIGH LOW with $I_{Load} = 20$ mA	typ 3.8 V typ 1.3 V		
Resolution, singleturn	10 ... 17 bit			
Code	Binary or Gray			
SSI clock rate	resolution \leq 14 bit resolution \geq 15 bit	50 kHz ... 2 MHz 50 kHz ... 125 kHz		
Monoflop time	\leq 15 μ s			
Note:	If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.			
Data refresh rate	resolution \leq 14 bit resolution \geq 15 bit	\leq 1 μ s 4 μ s		
Status and parity bit	on request			
BiSS-C interface				
Resolution, singleturn	10 ... 17 bit			
Code	Binary			
BiSS-C clock rate	50 kHz ... 10 MHz			
Max. update rate	< 10 μ s, depends on the clock rate and the data length			
Data refresh rate	\leq 1 μ s			
Note:	<ul style="list-style-type: none"> – Bidirectional, factory programmable parameters are: resolution, code, direction, alarms and warnings – CRC data verification 			
Incremental outputs (A/B), 2048 ppr				
	SinCos	RS422 TTL-compatible		
Max. frequency -3dB	400 kHz	400 kHz		
Signal level	1 Vpp (\pm 20%)	HIGH: min. 2.5 V LOW: max. 0.5 V		
Short circuit proof	yes ¹⁾	yes ¹⁾		
SET input				
Input	active HIGH			
Input type	comparator			
Signal level	HIGH (+V = power supply)	min. 60 % of +V, max: +V		
	LOW	max. 30 % of +V		
Input current	< 0.5 mA			
Min. pulse duration (SET)	10 ms			
Input delay	1 ms			
New position data readable after	1 ms			
Internal processing time	200 ms			
<p>The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET input has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS-C. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.</p> <p>The SET function should be carried out whilst the encoder is at rest.</p>				
DIR input				
<p>A HIGH signal switches the direction of rotation from the default CW to CCW. This inverted function can also be factory-programmed. If DIR is changed when the device is already switched on, then this will be interpreted as an error. The status output will switch to LOW.</p>				
Response time (DIR input)				
	1 ms			
Status output				
Output driver	Open Collector, internal pull up resistor 22 kOhm			
Permissible load	max. 20 mA			
Signal level	HIGH LOW	+V < 1 V		
Active	LOW			
<p>The status output serves to display various alarm or error messages. In normal operation the status output is HIGH (Open Collector with int. pull-up 22 kOhm).</p> <p>An active status output (LOW) displays:</p> <p>LED fault (failure or ageing) – over-temperature – undervoltage</p> <p>In the SSI mode, the fault indication can only be reset by switching off the power supply to the device.</p>				
Power ON				
<p>After Power-ON the device requires a time of approx. 150 ms before valid data can be read.</p> <p>Hot plugging of the encoder should be avoided.</p>				

1) Short circuit proof to 0 V or to output when power supply correctly applied

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Compact Optical	Sendix F3653 / F3673 (Shaft / Hollow shaft)	SSI / BiSS-C
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Terminal assignment

Interface	Type of connection	Features	Cable (Isolate unused wires individually before initial start-up)												
1, 2	1, 3	SET, DIR, Status	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	Stat	+		
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	VT	Shield		
Interface	Type of connection	Features	M12 connector												
1, 2	8	SET, DIR	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR		+		
			Pin:	1	2	3	4	5	6	7	8		PH		
Interface	Type of connection	Features	Cable (Isolate unused wires individually before initial start-up)												
3, 4	1, 3	SET, DIR, 2048 SinCos	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	A	Ā	B	Ā
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU
Interface	Type of connection	Features	Cable (Isolate unused wires individually before initial start-up)												
5	1, 3	SET, DIR, Sensor output	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	0 Vsens	+Vsens	+	
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	VT		RD-BU	Shield
Interface	Type of connection	Features	Cable (Isolate unused wires individually before initial start-up)												
6	1, 3	2048 SinCos, Sensor output	Signal:	0 V	+V	C+	C-	D+	D-	0 Vsens	+Vsens	A	Ā	B	Ā
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU
Interface	Type of connection	Features	Cable (Isolate unused wires individually before initial start-up)												
7, 8	1, 3	2048 incr. RS422	Signal:	0 V	+V	C+	C-	D+	D-	A	Ā	B	Ā	+	
			Cable colour:	WH	BN	GN	YE	GY	PK	BK	VT	GY-PK	RD-BU		Shield

+V: Encoder power supply +V DC

0 V: Encoder power supply ground GND (0 V)

0 Vsens / +Vsens: Using the sensor outputs of the encoder, the voltage present can be measured and if necessary increased accordingly.

A, Ā: Incremental output channel A

B, ĀĀ: Incremental output channel B

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.

Stat: Status output

PH $\frac{1}{2}$: Plug connector housing (Shield)

Top view of mating side, male contact base



M12 connector, 8-pin

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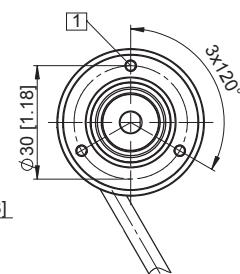
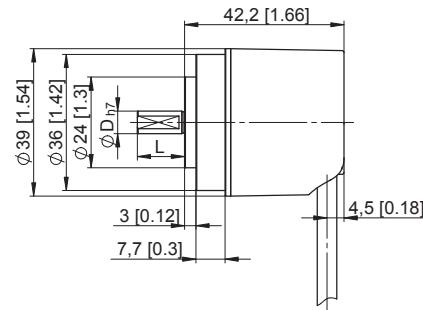
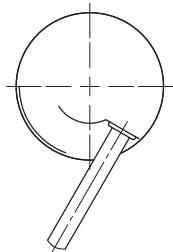
SSI / BiSS-C

Dimensions shaft version

Dimensions in mm [inch]

Clamping flange, \varnothing 36 [1.42]
Flange type 1 and 3

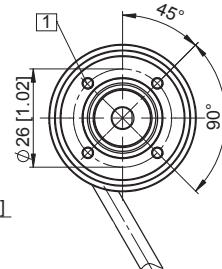
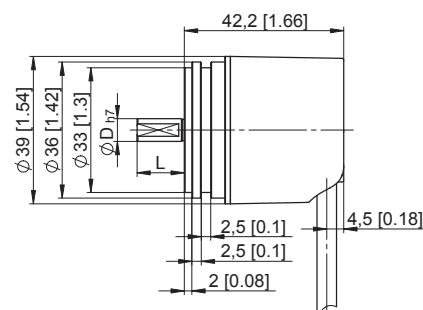
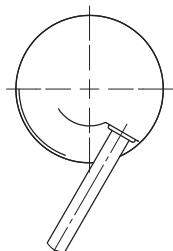
3 x M3, 6 [0.24] deep



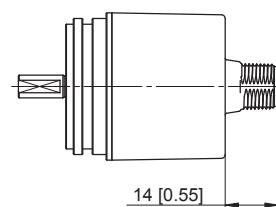
D	L	Fit
6 [0.24]	12.5 [0.49]	h7
8 [0.32]	15 [0.59]	h7
10 [0.39]	20 [0.79]	h7
1/4"	12.5 [0.49]	h7
3/8"	5/8"	h7

Synchro flange, \varnothing 36 [1.42]
Flange type 2 and 4
(Drawing with cable)

3 x M3, 6 [0.24] deep



Drawing with M12 connector
Type of connection 8



D	L	Fit
6 [0.24]	12.5 [0.49]	h7
8 [0.32]	15 [0.59]	h7
10 [0.39]	20 [0.79]	h7
1/4"	12.5 [0.49]	h7
3/8"	5/8"	h7

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**Compact
Optical**

Sendix F3653 / F3673 (Shaft / Hollow shaft)

SSI / BiSS-C

Dimensions hollow shaft version

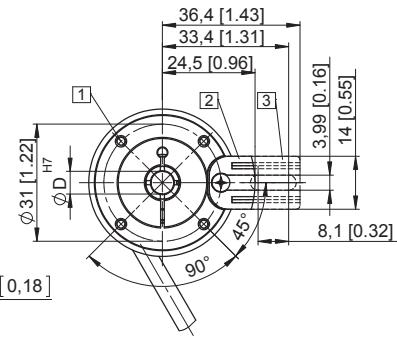
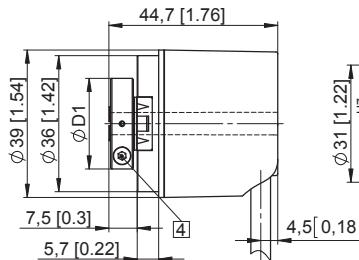
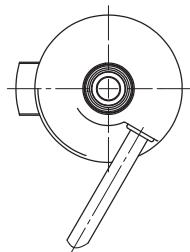
Dimensions in mm [inch]

Flange with spring element

Flange type 1 and 3

(Drawing with spring element short, spring element long is shown dashed)

- [1] M2.5, 5 [0.2] deep
- [2] Spring element short
Recommendation:
Cylindrical pin DIN 7, ø 4 [0.16]
- [3] Spring element long
Recommendation:
Cylindrical pin DIN 7, ø 4 [0.16]
- [4] Recommended torque for the
clamping ring 0.7 Nm



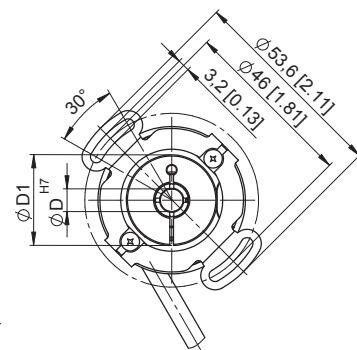
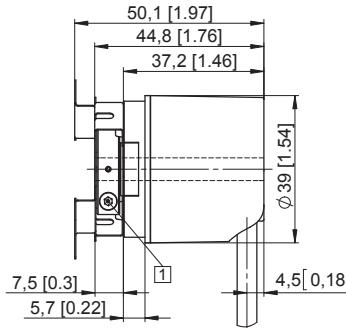
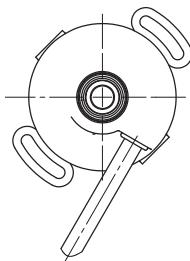
D	D1
6 [0.24]	24 [0.94]
8 [0.32]	25.5 [1.00]
10 [0.39]	25.5 [1.00]
1/4"	24 [0.94]

Insertion depth for blind hollow shaft 14.5 [0.57]

Flange with stator coupling, ø 46 [1.81]

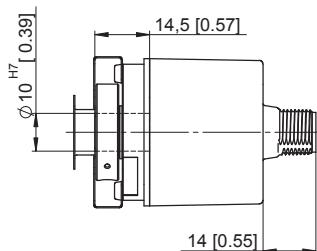
Flange type 2

- [1] Recommended torque for the
clamping ring 0.7 Nm



D	D1
6 [0.24]	24 [0.94]
8 [0.32]	25.5 [1.00]
10 [0.39]	25.5 [1.00]
1/4"	24 [0.94]

Insertion depth for blind hollow shaft 14.5 [0.57]



Drawing with M12 connector
Type of connection 8