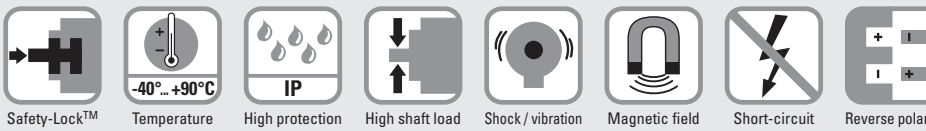
Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS + incremental**



The Sendix F36 singleturn with the patented Intelligent Scan Technology™ and SSI or BiSS interface boasts exceptional ruggedness and compact dimensions.

With a size of just 36 x 42 mm it offers a through hollow shaft of up to 8 mm or a blind hollow shaft of up to 10 mm. Its high-precision optical sensor technology can achieve a resolution of up to 17 bits.



Safety-Lock™ | Temperature range | High protection level | High shaft load capacity | Shock / vibration resistant | Magnetic field proof | Short-circuit proof | Reverse polarity protection | SinCos | Intelligent Scan Technology™ | Surface protection salt spray-tested optional

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 multiturn functions on one single OptoASIC - offering highest reliability, a high resolution up to 17 bits and 100 % magnetic field insensitiveness.

Optimized performance

- High-precision with a data refresh rate of the position value ≤ 1µs.
- 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 up to 10 MHz.

Order code Shaft version

8.F3653	.	X	X	X	X	.	X	X	12
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.

10 by 10

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“]

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“

c *Interface / supply voltage*
1 = SSI, BiSS / 5 V DC
2 = SSI, BiSS / 10 ... 30 V DC
3 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC
4 = SSI, BiSS + 2048 ppr. SinCos / 10 ... 30 V DC
5 = SSI, BiSS / 5 V DC, with sensor output
6 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC, with sensor output
7 = SSI, BiSS + 2048 ppr. RS422 / 5 V DC
8 = SSI, BiSS + 2048 ppr. RS422 / 10 ... 30 V DC

d *Type of connection*
1 = tangential cable, 1 m [3.28] PUR
3 = tangential cable, 5 m [16.40] PUR
F = tangential cable, special length PUR *)
8 = axial M12 connector, 8-pin [1)]

*) Available special lengths (connection type F):
2, 3, 8, 10, 15 m [6.56, 9.84, 26.25, 32.80, 49.21']
order code expansion .XXXX = length in dm
ex.: 8.F3653.432F.G312.0030 (for cable length 3 m)

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

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

Optional on request
- surface protection salt spray tested
- other resolutions

1) Only with output circuits 1 and 2.

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Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS + incremental**

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 **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 = with spring element, short, IP65
3 = with spring element, long, IP65
2 = with stator coupling, IP65, ø 46 mm [1.81"]

b *Through hollow shaft*
1 = ø 6 mm [0.24"]
3 = ø 8 mm [0.32"]
2 = ø 1/4"
Blind hollow shaft
(insertion depth max. 14.5 mm [0.57"])
4 = ø 10 mm [0.39"]

c *Interface / supply voltage*
1 = SSI, BiSS / 5 V DC
2 = SSI, BiSS / 10 ... 30 V DC
3 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC
4 = SSI, BiSS + 2048 ppr. SinCos / 10 ... 30 V DC
5 = SSI, BiSS / 5 V DC, with sensor output
6 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC, with sensor output
7 = SSI, BiSS + 2048 ppr. RS422 / 5 V DC
8 = SSI, BiSS + 2048 ppr. RS422 / 10 ... 30 V DC

d *Type of connection*
1 = tangential cable, 1 m [3.28] PUR
3 = tangential cable, 5 m [16.40] PUR
F = tangential cable, special length PUR *)
8 = axial M12 connector, 8-pin [1)]

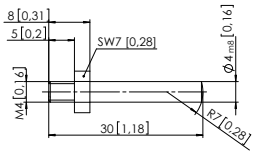
*) Available special lengths (connection type F):
2, 3, 8, 10, 15 m [6.56, 9.84, 26.25, 32.80, 49.21']
order code expansion .XXXX = length in dm
ex.: 8.F3673.242F.G312.0030 (for cable length 3 m)

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

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

Optional on request
- surface protection salt spray tested
- other resolutions

Mounting accessory for shaft encoders		Order no.
Coupling	Bellows coupling ø 19 mm [0.75"] for shaft 8 mm [0.32"]	**8.0000.1102.0808**

Mounting accessory for hollow shaft encoders Dimensions in mm [inch]		Order no.
Torque pin, ø 4 mm for flange with spring element (flange type 3 + 6)	with fixing thread 	**8.0010.4700.0000**

Cables and connectors		Order no.
Preassembled cables	M12 female connector with coupling nut, 8-pin, A coded, straight open ended 2 m [6.56'] PUR cable	**05.00.6051.8211.002M**
Connectors	M12 female connector with coupling nut, 8-pin, A coded, straight (metal)	**05.CMB 8181-0**

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

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 + incremental**

Technical data

Mechanical characteristics

Maximum speed shaft version without shaft seal (IP65) or blind hollow shaft version		12000 min^{-1} 10000 min^{-1} (continuous)
shaft version with shaft seal (IP67) or hollow shaft version		10000 min^{-1} 8000 min^{-1} (continuous)
Starting torque at 20 °C [68 °F]	without shaft seal	< 0.007 Nm
	with shaft seal (IP67	< 0.01 Nm
Shaft load capacity	radial	40 N
	axial	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]
Materials	shaft / hollow shaft	stainless steel
	flange	aluminum
	housing	zinc die-cast
	cable	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

Electrical characteristics

Supply voltage		5 V DC (±5 %) or 10 ... 30 V DC
Current consumption (no load)	5 V DC	max. 60 mA
	10 ... 30 V DC	max. 30 mA
Reverse polarity protection of the supply voltage		yes (only with 10 ... 30 V DC)
Short-circuit proof outputs		yes [1]

SSI interface

Output driver		RS485 transceiver type
Permissible load / channel		max. +/- 30 mA
Signal level	HIGH	typ. 3.8 V
	LOW with I_{Load} = 20 mA	typ. 1.3 V
Resolution		10 ... 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 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.

BiSS interface

Output driver		RS485 transceiver type
Permissible load / channel		max. +/- 30 mA
Signal level	HIGH	typ. 3.8 V
	LOW with I_{Load} = 20 mA	typ. 1.3 V
Resolution		10 ... 17 bit
Code		binary
BiSS clock rate		50 kHz ... 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

Incremental outputs (A/B)

	SinCos	RS422 TTL compatible
Max. frequency -3dB	400 kHz	400 kHz
Signal level	1 Vpp (±20 %)	HIGH: min. 2.5 V LOW: max. 0.5 V
Short circuit proof	yes [1]	yes [1]
Pulse rate	2048 ppr	2048 ppr

Status output

Output driver		open collector, internal pull up resistor 22 kOhm
Permissible load		max. 20 mA
Signal level	HIGH	+V
	LOW	< 1 V
Active		LOW

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).

An active status output (LOW) displays: LED fault (failure or ageing) – over-temperature – undervoltage In the SSI mode, the fault indication can only be reset by switching off the supply voltage to the device.

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

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Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS + incremental**

SET input

Input		active HIGH
Input type		comparator
Signal level (+V = supply voltage)	HIGH LOW	min. 60 % of +V, max: +V 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

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. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the supply voltage must not be switched off.
The SET function should be carried out whilst the encoder is at rest.
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 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.

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.

Approvals

UL compliant in accordance with	File no. E224618
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU

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Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS + incremental**

Terminal assignment

Interface	Type of connection	Features	Cable (isolate unused cores individually before initial start-up)									
1, 2	1, 3, F	SET, DIR, Status	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	Stat	⏚
			Core color:	WH	BN	GN	YE	GY	PK	BU	RD	VT	shield

Interface	Type of connection	Features	M12 connector, 8-pin								
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 cores individually before initial start-up)												
3, 4	1, 3, F	SET, DIR, 2048 SinCos	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	A	$\overline{A}$	B	$\overline{B}$	⏚
			Core color:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU	shield

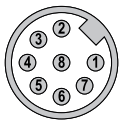
Interface	Type of connection	Features	Cable (isolate unused cores individually before initial start-up)										
5	1, 3, F	SET, DIR, Sensor output	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	0 Vsens	+Vsens	⏚
			Core color:	WH	BN	GN	YE	GY	PK	BU	RD	VT	RD-BU	shield

Interface	Type of connection	Features	Cable (isolate unused cores individually before initial start-up)													
6	1, 3, F	2048 SinCos, Sensor output	Signal:	0 V	+V	C+	C-	D+	D-	0 Vsens	+Vsens	A	$\overline{A}$	B	$\overline{B}$	⏚
			Core color:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU	shield

Interface	Type of connection	Features	Cable (isolate unused cores individually before initial start-up)											
7, 8	1, 3, F	2048 incr. RS422	Signal:	0 V	+V	C+	C-	D+	D-	A	$\overline{A}$	B	$\overline{B}$	⏚
			Core color:	WH	BN	GN	YE	GY	PK	BK	VT	GY-PK	RD-BU	shield

+V: Supply voltage encoder +V DC
0 V: Supply voltage encoder 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.
C+, C-: Clock signal
D+, D-: Data signal
A, $\overline{A}$: Incremental output channel A (cosine)
B, $\overline{B}$: Incremental output channel B (sine)
SET: Set input
DIR: Direction input
PH ⏚: Plug connector housing (shield)

Top view of mating side, male contact base



M12 connector, 8-pin

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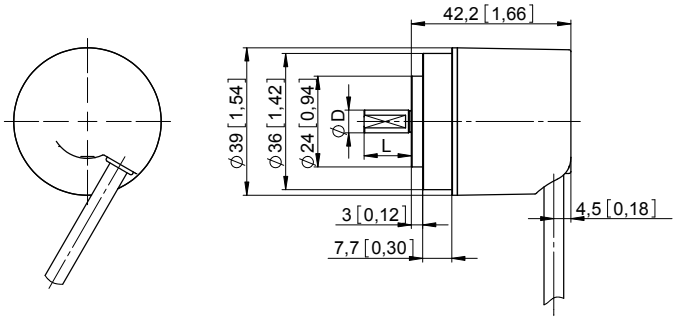
Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS + incremental**

Dimensions shaft version

Dimensions in mm [inch]

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

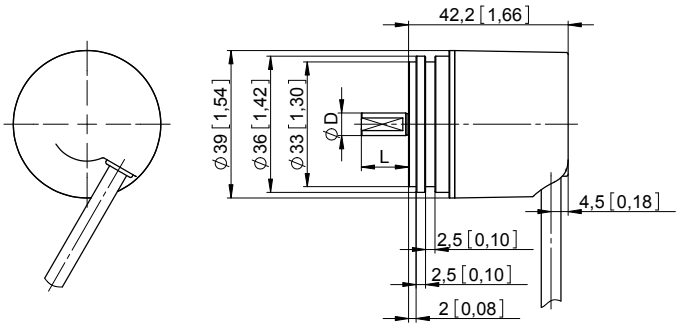
1 3 x M3, 6 [0.24] deep



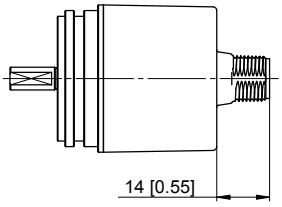
D	Fit	L
6 [0.24]	h7	12.5 [0.49]
8 [0.32]	h7	15 [0.59]
10 [0.39]	f7	20 [0.79]
1/4"	h7	12.5 [0.49]
3/8"	h7	5/8"

Synchro flange, ø 36 [1.42]
Flange type 2 and 4
(drawing with cable)

1 4 x M3, 6 [0.24] deep



D	Fit	L
6 [0.24]	h7	12.5 [0.49]
8 [0.32]	h7	15 [0.59]
10 [0.39]	f7	20 [0.79]
1/4"	h7	12.5 [0.49]
3/8"	h7	5/8"



Drawing with M12 connector and type of connection 8

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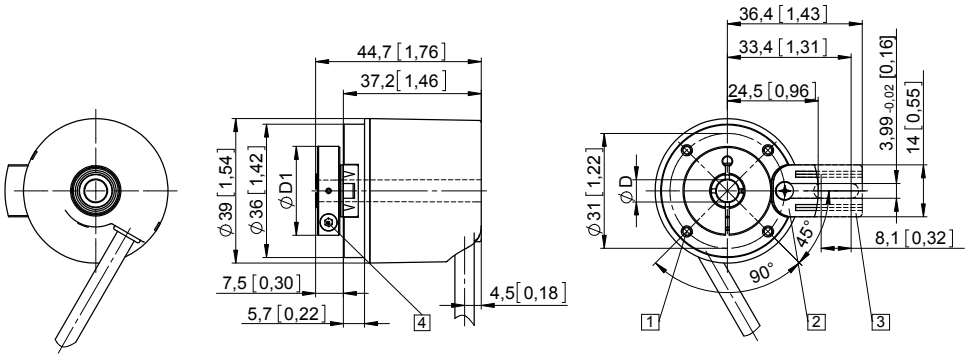
Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS + incremental**

Dimensions hollow shaft version

Dimensions in mm [inch]

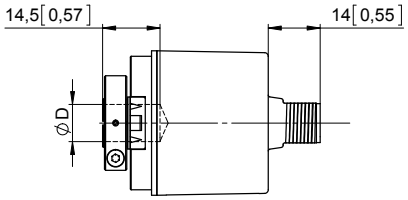
Flange with spring element
Flange type 1 and 3
(drawing with spring element short, spring element long is shown dashed)

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



D	Fit	D1
6 [0.24]	H7	24 [0.94]
8 [0.32]	H7	25.5 [1.00]
10 [0.39] *)	H7	25.5 [1.00]
1/4"	H7	24 [0.94]

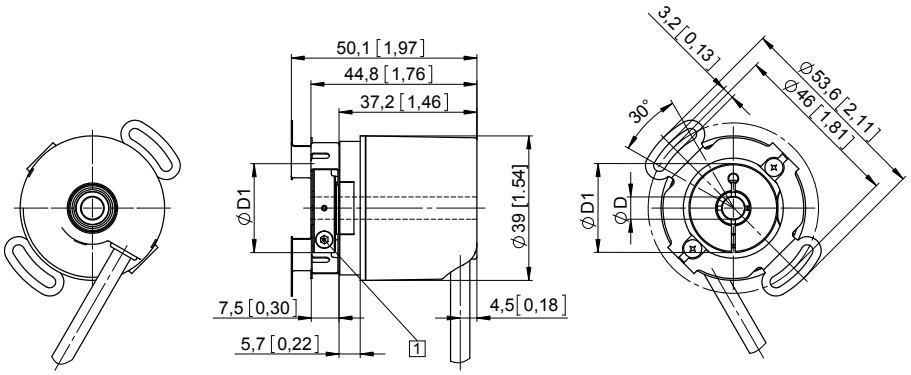
*) Blind hollow shaft, insertion depth max. = 14.5 mm [0.57"]



Blind hollow shaft for D = ø 10
drawing with M12 connector and type of connection 8

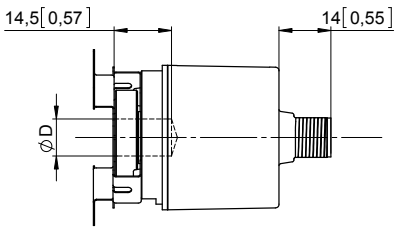
Flange with stator coupling, ø 46 [1.81"]
Flange type 2

1 Recommended torque for the clamping ring 0.7 Nm



D	Fit	D1
6 [0.24]	H7	24 [0.94]
8 [0.32]	H7	25.5 [1.00]
10 [0.39] *)	H7	25.5 [1.00]
1/4"	H7	24 [0.94]

*) Blind hollow shaft, insertion depth max. = 14.5 mm [0.57"]



Blind hollow shaft for D = ø 10
drawing with M12 connector and type of connection 8