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

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.

Optimised 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 / power supply*
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.

Absolute encoders - singleturn

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

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 *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"

c *Interface / power supply*
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)]

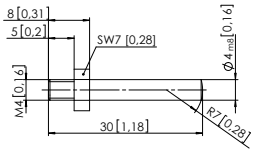
*) Available special lengths (connection type F):
2, 3, 8, 10, 15 m [6.56, 9.84, 26.25, 32.80, 49.21']
order code expansion .XXXX = length in dm
ex.: 8.F3673.242F.G312.0030 (for cable length 3 m)

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 6 mm [0.24"]	**8.0000.1102.0606**

Mounting accessory for hollow shaft encoders		Order no.
Cylindrical pin, long for torque stops	 with fixing thread	**8.0010.4700.0000**

Connection technology		Order no.
Connector, self-assembly (straight)	M12 female connector with coupling nut (suitable for connection type 8)	**05.CMB 8181-0**
Cordset, pre-assembled	M12 female connector with coupling nut, 2 m [6.56'] PVC cable (suitable for connection type 8)	**05.00.6041.8211.002M**

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 version without shaft seal (IP65)		12000 min^{-1}
or blind hollow shaft version		10000 min^{-1} (continuous)
shaft version with shaft seal (IP67)		10000 min^{-1}
or hollow shaft version		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	aluminium
	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

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

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

Electrical characteristics

Power supply		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 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 2014/30/EU RoHS guideline 2011/65/EU

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	resolution ≤ 14 bit	≤ 1 µs
	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

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	≤ 1 µs

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

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 power supply to the device.

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

SET input

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

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 power supply 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 Time

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.

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

Absolute encoders - singleturn

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

Terminal assignment

Interface	Type of connection	Features	Cable (isolate unused wires individually before initial start-up)									
1, 2	1, 3, F	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, 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 wires 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	$\overline{B}$	⏚
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU	shield

Interface	Type of connection	Features	Cable (isolate unused wires individually before initial start-up)											
5	1, 3, F	SET, DIR, Sensor output	Signal:	0 V	+V	C+	C-	D+	D-	SET	DIR	0 V_{sens}	+V_{sens}	⏚
			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, F	2048 SinCos, Sensor output	Signal:	0 V	+V	C+	C-	D+	D-	0 Vsens	+Vsens	A	$\overline{A}$	B	$\overline{B}$	⏚
			Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY-PK	RD-BU	shield

Interface	Type of connection	Features	Cable (isolate unused wires 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	$\overline{B}$	⏚
			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 V_{sens} / +V_{sens}: 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

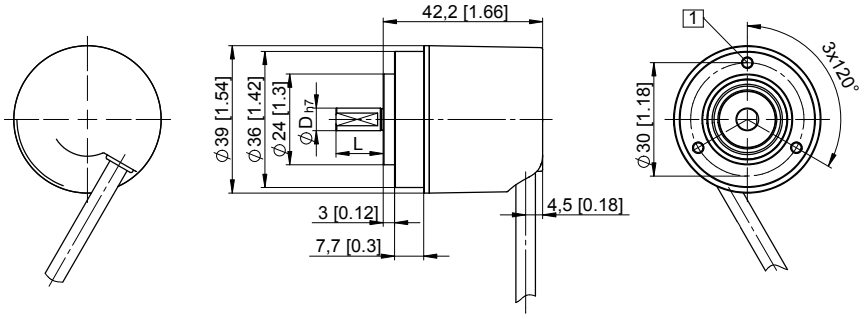
Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS**

Dimensions shaft version

Dimensions in mm [inch]

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

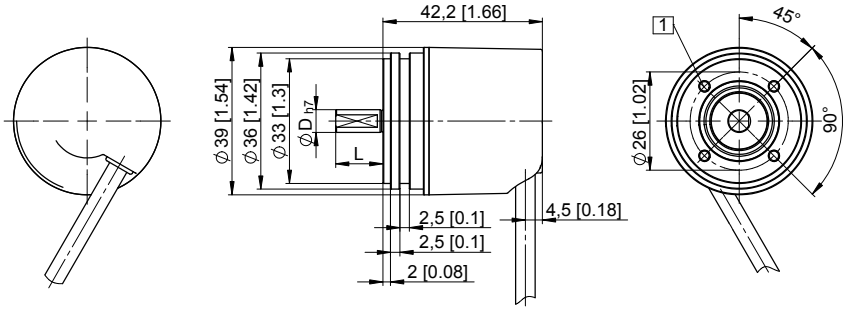
1 3 x M3, 6 [0.24] deep



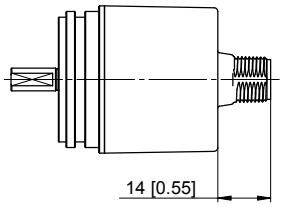
D	L	Fit
6 [0.24]	12.5 [0.49]	h7
8 [0.32]	15 [0.59]	h7
10 [0.39]	20 [0.79]	h7
1/4“	12.5 [0.49]	h7
3/8“	5/8“	h7

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

1 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

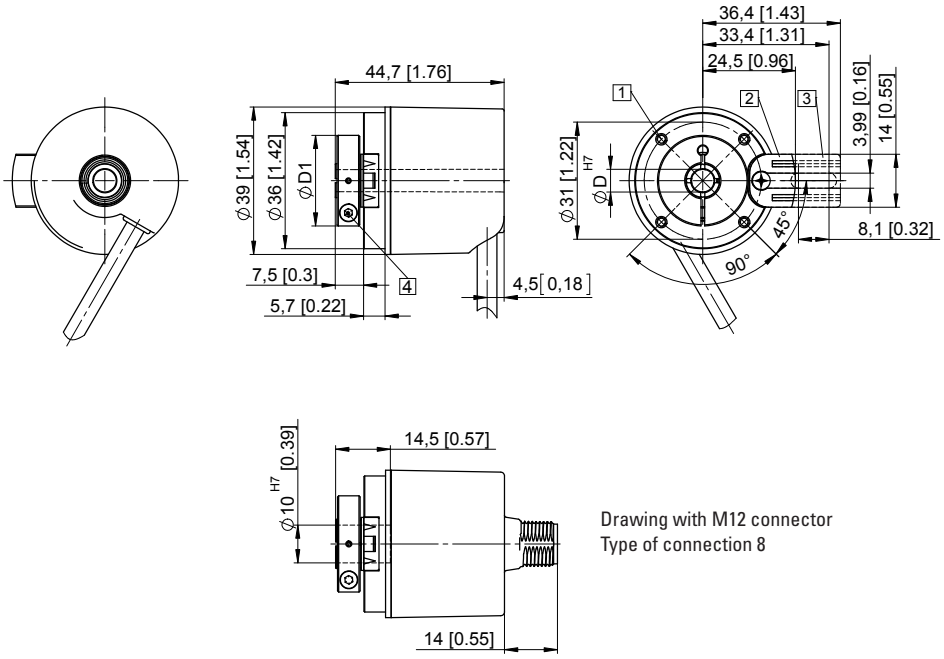
Compact optical | **Sendix F3653 / F3673 (shaft / hollow shaft)** | **SSI / BiSS**

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



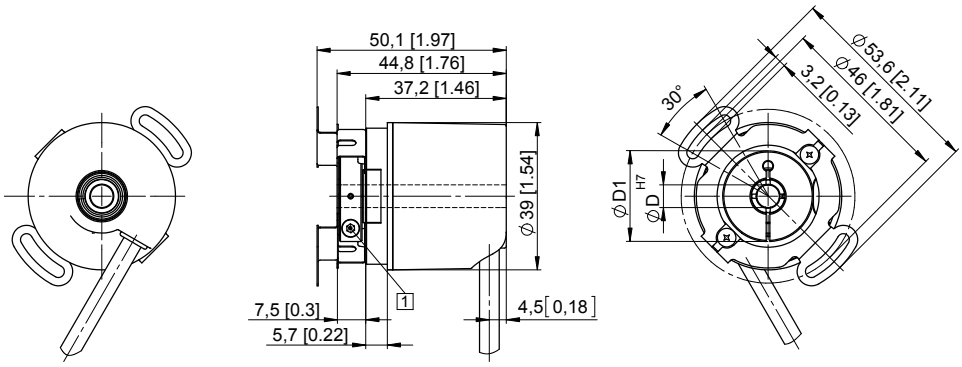
Drawing with M12 connector
Type of connection 8

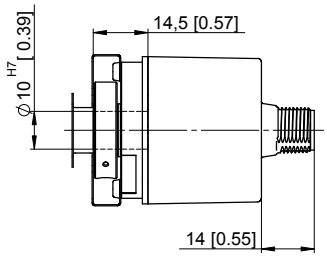
D	D1
6 [0.24]	24 [0.94]
8 [0.32]	25.5 [1.00]
10 [0.39]	25.5 [1.00]
1/4"	24 [0.94]

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





Drawing with M12 connector
Type of connection 8

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]