

## Incremental encoders

### Standard optical

Sendix 5000 / 5020 (shaft / hollow shaft)

Push-Pull / RS422 / Open collector



Due to their sturdy bearing construction in Safety-Lock™ Design, the Sendix 5000 and 5020 offer high resistance against vibration and installation errors.

The rugged housing, high protection level of up to IP67, as well as the wide temperature range of -40 °C up to +85 °C, make this product range the perfect encoder for all applications.



Safety-Lock™



High rotational speed



Temperature range -40...+85 °C



High protection level IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit proof



Reverse polarity protection



Optical sensor

### Robust performance

- Increased resistance against shock, vibrations and tolerance of installation errors, elimination of machine downtime and repairs thanks to sturdy bearing construction in "Safety-Lock™ Design".
- Ensures highest safety against field breakdowns and is thus suitable also for outside use thanks to its resistant die-cast housing and protection up to IP67.
- Undetachable clamping ring on hollow shaft encoders.
- Wide temperature range, -40 °C ... +85 °C.

### Many variants

- Suitable connection variant for every specific case: cable connection with different standard lengths, M12 (5- or 8-pin), M23 (12-pin), MIL (7- or 10-pin) and Sub-D connector. In addition: Variants with connector fitted in the cable – for error-free electrical connection to your control.
- Reliable mounting in a wide variety of installation situations: comprehensive and proven fixing possibilities.
- Compatible with all US and European standards.
- Wide range of standard pulse ranges up to max. 5000 pulses per revolution.

### Technology in detail

Robust Safety-Lock™ bearing structure



Cables with fitted connector



Undetachable clamping ring

Slotted clamping ring + slotted shaft



Tangential cable outlet



# Incremental encoders

**Standard  
optical**

Sendix 5000 / 5020 (shaft / hollow shaft)

Push-Pull / RS422 / Open collector

**Order code** 8.5000 . XXXX . XXXX . PXXXX  
**Shaft version** Type 

## Flange

- 5 – synchro flange, IP66/IP67 ø 50.8 mm [2"]
- 6 – synchro flange, IP65 ø 50.8 mm [2"]
- A – synchro flange, IP66/IP67 ø 58 mm [2.28"]**
- B – synchro flange, IP65 ø 58 mm [2.28"]**
- 7 – clamping flange, IP66/IP67 ø 58 mm [2.28"]**
- 8 – clamping flange, IP65 ø 58 mm [2.28"]**
- 3 – square flange, IP66/IP67 □ 52.3 mm [2.06"]
- 4 – square flange, IP65 □ 52.3 mm [2.06"]
- C – square flange, IP66/IP67 □ 63.5 mm [2.5"]
- D – square flange, IP65 □ 63.5 mm [2.5"]
- 1 – servo flange, IP66/IP67 ø 50.8 mm [2"]
- 2 – servo flange, IP65 ø 50.8 mm [2"]
- E – servo flange, IP66/IP67 ø 63.5 mm [2.5"]
- F – servo flange, IP65 ø 63.5 mm [2.5"]
- G – Euro flange, IP66/IP67 ø 115 mm [4.53"]<sup>1)</sup>

## Shaft (ø x L), with flat

- 1 – ø 6 x 10 mm [0.24 x 0.39"]**
- 2 – ø 1/4 x 5/8" (6.35 x 15.875 mm)
- 7 – ø 1/4 x 7/8"
- 6 – ø 8 x 15 mm [0.32 x 0.59"]
- 3 – ø 10 x 20 mm [0.39 x 0.79"]**
- 4 – ø 3/8 x 5/8" (9.5 x 15.875 mm)
- 8 – ø 3/8 x 7/8"
- B – ø 11 x 33 mm [0.43 x 1.30"], with feather key shaft slot<sup>2)</sup>
- 5 – ø 12 x 20 mm [0.47 x 0.79"]

## Output circuit (with inverted signal) / power supply

- 4 – RS422 / 5 V DC**
- 1 – RS422 / 5 ... 30 V DC**
- 2 – Push-Pull (7272 compatible) / 5 ... 30 V DC**
- 5 – Push-Pull / 10 ... 30 V DC**
- 8 – Push-Pull (7272 compatible), without capacitor / 5 ... 30 V DC<sup>3)</sup>
- 3 – Open collector / 5 ... 30 V DC**

## Type of connection – cable

- 1 – axial cable, 1 m [3.28 ft] PVC**
- A – axial cable, special length PVC \*)
- 2 – radial cable, 1 m [3.28 ft] PVC**
- B – radial cable, special length PVC \*)

## Type of connection – connector

- P – axial M12 connector, 5-pin<sup>4)</sup>
- R – radial M12 connector, 5-pin<sup>4)</sup>
- 3 – axial M12 connector, 8-pin**
- 4 – radial M12 connector, 8-pin**
- 7 – axial M23 connector, 12-pin**
- 8 – radial M23 connector, 12-pin**
- Y – radial MIL connector, 10-pin**
- W – radial MIL connector, 7-pin<sup>4)</sup>**
- 9 – radial MIL connector, 6-pin<sup>4)</sup>

## Type of connection – connector with cable

- L – radial cable with M12 connector, 8-pin, special length PVC \*)
- M – radial cable with M23 connector, 12-pin, special length PVC \*)
- N – radial cable with Sub-D connector, 9-pin, special length PVC \*)

\*) Available special lengths (connection types A, B, L, M, N:  
0.3, 0.5, 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20 m [0.98, 1.64, 3.28, 6.56, 9.84,  
13.12, 16.40, 19.69, 26.25, 32.80, 39.37, 49.21, 65.62 ft])  
order code expansion .XXXX – length in dm  
ex.: 8.5000.814A.1024.0030.PXXXX (for cable length 3 m)

## Pulse rate

- 1, 2, 4, 5, 10, 12, 14, 20, 25, 28, 30, 32, 36, 50, 60, 64, 80, 100, 120, 125,  
150, 180, 200, 240, 250, 256, 300, 342, 360, 375, 400, 500, 512, 600,  
625, 720, 800, 900, 1000, 1024, 1200, 1250, 1500, 1800, 2000, 2048,  
2500, 3000, 3600, 4000, 4096, 5000**
- (e.g. 100 pulses → 0100)

## Special output signal formats

- 00 – standard output**
- other – see page 9

## Capacitor

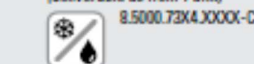
- 0 – standard**
- A – no bypass capacitor (vector motor)
- (only valid with output circuits 1, 3, 4, 5)

## Special connector pin configuration

- 0 – standard wiring**
- other – see page 7

- Optional on request
- other pulse rates
- Ex 2/22 only for variants with IP66/IP67<sup>5)</sup>
- (not for type of connection L, M, N)
- surface protection salt spray

Salt spray tested as standard type  
(deliverable as from 1 unit)



8.5000.73X4.XXXX-C

1) Only in conjunction with shaft type B.  
2) Only in conjunction with flange type G.  
3) Attention: no CE types!  
4) Without inverted signal.  
5) For type of connection cable, the cable material is PUR.

## Incremental encoders

| Standard optical | Sendix 5000 / 5020 (shaft / hollow shaft) | Push-Pull / RS422 / Open collector |
|------------------|-------------------------------------------|------------------------------------|
|------------------|-------------------------------------------|------------------------------------|

### Technical data

| Mechanical characteristics                       |                                                                                                                                                | Approvals                              |                                   |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------|
| <b>Weight</b>                                    | approx. 0.4 kg [14.11 oz]                                                                                                                      | <b>UL compliant</b> in accordance with | File no. E224618                  |
| <b>Protection</b> acc. to EN 60529               | without shaft seal IP65<br>with shaft seal IP66/IP67                                                                                           | <b>CE compliant</b> in accordance with |                                   |
| <b>Working temperature range</b>                 | -40 °C <sup>1)</sup> ... +85 °C [-40 °F <sup>1)</sup> ... +185 °F]                                                                             | EMC Directive                          | 2014/30/EU                        |
| <b>Material</b>                                  | shaft stainless steel                                                                                                                          | RoHS Directive                         | 2011/65/EU                        |
| <b>Shock resistance</b> acc. to EN 60068-2-27    | 3000 m/s <sup>2</sup> , 6 ms <sup>2)</sup>                                                                                                     | ATEX Directive                         | 2014/34/EU (for Ex 2/22 variants) |
| <b>Vibration resistance</b> acc. to EN 60068-2-6 | 300 m/s <sup>2</sup> , 10 ... 2000 Hz <sup>3)</sup>                                                                                            |                                        |                                   |
| <b>Maximum speed</b>                             | IP65 12000 min <sup>-1</sup><br>6000 min <sup>-1</sup> (continuous)<br>IP66/IP67 6000 min <sup>-1</sup><br>3000 min <sup>-1</sup> (continuous) |                                        |                                   |
| <b>Mass moment of inertia</b>                    | shaft version approx. 1.8 x 10 <sup>-6</sup> kgm <sup>2</sup><br>hollow shaft version approx. 6 x 10 <sup>-6</sup> kgm <sup>2</sup>            |                                        |                                   |
| <b>Starting torque</b> at 20 °C [68 °F]          | IP65 < 0.01 Nm<br>IP66/IP67 < 0.05 Nm                                                                                                          |                                        |                                   |
| <b>Shaft load capacity</b>                       | radial 100 N<br>axial 50 N                                                                                                                     |                                        |                                   |

| Electrical characteristics                             |                                   |                          |                               |                                                |                                                |                       |
|--------------------------------------------------------|-----------------------------------|--------------------------|-------------------------------|------------------------------------------------|------------------------------------------------|-----------------------|
| Output circuit                                         | RS422 (TTL compatible)            | RS422 (TTL compatible)   | Push-pull                     | Push-pull (HTL/TTL universal, 7272 compatible) | Push-pull (7272 compatible, without capacitor) | Open collector (7273) |
| Order code                                             | 1                                 | 4                        | 5                             | 2                                              | 8                                              | 3                     |
| <b>Power supply</b>                                    | 5 ... 30 V DC                     | 5 V DC (±5 %)            | 10 ... 30 V DC                | 5 ... 30 V DC                                  | 5 ... 30 V DC                                  | 5 ... 30 V DC         |
| <b>Power consumption</b> (no load)                     | typ. 40 mA<br>max. 90 mA          | typ. 40 mA<br>max. 90 mA | typ. 50 mA<br>max. 100 mA     | typ. 50 mA<br>max. 100 mA                      | typ. 50 mA<br>max. 100 mA                      | 100 mA                |
| <b>Permissible load / channel</b>                      | max. +/- 20 mA                    | max. +/- 20 mA           | max. +/- 20 mA                | max. +/- 20 mA                                 | max. +/- 20 mA                                 | 20 mA sink at 30 V DC |
| <b>Pulse frequency</b>                                 | max. 300 kHz                      | max. 300 kHz             | max. 300 kHz                  | max. 300 kHz <sup>4)</sup>                     | max. 300 kHz                                   | max. 300 kHz          |
| <b>Signal level</b>                                    | HIGH min. 2.5 V<br>LOW max. 0.5 V | min. 2.5 V<br>max. 0.5 V | min. +V - 1.0 V<br>max. 0.5 V | min. +V - 2.0 V<br>max. 0.5 V                  | min. +V - 2.0 V<br>max. 0.5 V                  |                       |
| <b>Rising edge time t<sub>r</sub></b>                  | max. 200 ns                       | max. 200 ns              | max. 1 µs                     | max. 1 µs                                      | max. 1 µs                                      |                       |
| <b>Falling edge time t<sub>f</sub></b>                 | max. 200 ns                       | max. 200 ns              | max. 1 µs                     | max. 1 µs                                      | max. 1 µs                                      |                       |
| <b>Short circuit proof outputs <sup>5)</sup></b>       | yes <sup>6)</sup>                 | yes <sup>6)</sup>        | yes                           | yes                                            | yes <sup>7)</sup>                              | yes                   |
| <b>Reverse polarity protection of the power supply</b> | yes                               | no                       | yes                           | no                                             | no                                             | no                    |

1) With connector: -40 °C [-40 °F], cable fixed; -30 °C [-22 °F], cable moved; -20 °C [-4 °F].

2) For MIL connectors: 2500 m/s<sup>2</sup>

3) For MIL connectors: 100 m/s<sup>2</sup>

4) Max. recommended cable length 30 m [98.43 ft].

5) If power supply correctly applied.

6) Only one channel allowed to be shorted out:

at +V: 5 V DC, short-circuit to channel, 0 V or +V is permitted.

at +V: 5 ... 30 V DC, short-circuit to channel or 0 V is permitted.

## Incremental encoders

### Standard optical

Sendix 5000 / 5020 (shaft / hollow shaft)

Push-Pull / RS422 / Open collector

#### Terminal assignment – Standard wiring

| Output circuit   | Type of connection | Cable (isolate unused wires individually before initial start-up) |              |     |    |         |           |           |                  |           |           |                  |           |                  |
|------------------|--------------------|-------------------------------------------------------------------|--------------|-----|----|---------|-----------|-----------|------------------|-----------|-----------|------------------|-----------|------------------|
| 1, 2, 3, 4, 5, 8 | 5000:              | 1, 2, A, B                                                        | Signal:      | 0 V | +V | 0 Vsens | +Vsens    | A         | $\bar{A}$        | B         | $\bar{B}$ | 0                | $\bar{0}$ | $\bar{+}$        |
|                  | 5020:              | 1, A, E, F                                                        | Core colour: | WH  | BN | GY PK   | RD BU     | GN        | YE               | GY        | PK        | BU               | RD        | shield           |
| Output circuit   | Type of connection | M12 connector, 5-pin                                              |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 2, 3, 4, 5, 8 | 5000:              | P, R                                                              | Signal:      | 0 V | +V | A       | B         | 0         | $\bar{+}$        |           |           |                  |           |                  |
|                  | 5020:              | R                                                                 | Pin:         | 1   | 2  | 3       | 4         | 5         | PH <sup>1)</sup> |           |           |                  |           |                  |
| Output circuit   | Type of connection | M12 connector, 8-pin                                              |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 2, 3, 4, 5, 8 | 5000:              | 3, 4, L                                                           | Signal:      | 0 V | +V | A       | $\bar{A}$ | B         | $\bar{B}$        | 0         | $\bar{0}$ | $\bar{+}$        |           |                  |
|                  | 5020:              | 2, H <sup>2)</sup> , L                                            | Pin:         | 1   | 2  | 3       | 4         | 5         | 6                | 7         | 8         | PH <sup>1)</sup> |           |                  |
| Output circuit   | Type of connection | M23 connector, 12-pin                                             |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 2, 3, 4, 5, 8 | 5000:              | 7, 8, M                                                           | Signal:      | 0 V | +V | 0 Vsens | +Vsens    | A         | $\bar{A}$        | B         | $\bar{B}$ | 0                | $\bar{0}$ | $\bar{+}$        |
|                  | 5020:              | 4, M                                                              | Pin:         | 10  | 12 | 11      | 2         | 5         | 6                | 8         | 1         | 3                | 4         | PH <sup>1)</sup> |
| Output circuit   | Type of connection | MIL connector, 10-pin                                             |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 2, 3, 4, 5, 8 | 5000:              | Y                                                                 | Signal:      | 0 V | +V | +Vsens  | A         | $\bar{A}$ | B                | $\bar{B}$ | 0         | $\bar{0}$        | $\bar{+}$ |                  |
|                  | 5020:              | 7                                                                 | Pin:         | F   | D  | E       | A         | G         | B                | H         | C         | I                | J         |                  |
| Output circuit   | Type of connection | MIL connector, 7-pin                                              |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 3, 4, 5, 8    | 5000:              | W                                                                 | Signal:      | 0 V | +V | +Vsens  | A         | B         | 0                | $\bar{+}$ |           |                  |           |                  |
|                  | 5020:              | 6                                                                 | Pin:         | F   | D  | E       | A         | B         | C                | G         |           |                  |           |                  |
| Output circuit   | Type of connection | MIL connector, 6-pin                                              |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 3, 4, 5, 8    | 5000:              | 9                                                                 | Signal:      | 0 V | +V | A       | B         | 0         | $\bar{+}$        |           |           |                  |           |                  |
|                  |                    |                                                                   | Pin:         | A   | B  | E       | D         | C         |                  |           |           |                  |           |                  |
| Output circuit   | Type of connection | Sub-D connector, 9-pin                                            |              |     |    |         |           |           |                  |           |           |                  |           |                  |
| 1, 2, 3, 4, 5, 8 | 5000:              | N                                                                 | Signal:      | 0 V | +V | A       | $\bar{A}$ | B         | $\bar{B}$        | 0         | $\bar{0}$ | $\bar{+}$        |           |                  |
|                  | 5020:              | N                                                                 | Pin:         | 9   | 5  | 1       | 6         | 2         | 7                | 3         | 8         | PH <sup>1)</sup> |           |                  |

1) PH - shield is attached to connector housing.



## Incremental encoders

### Standard optical

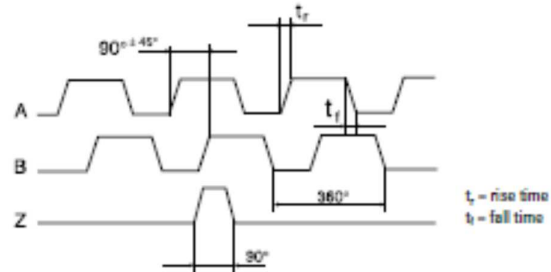
Sendix 5000 / 5020 (shaft / hollow shaft)

Push-Pull / RS422 / Open collector

#### Special output signal formats

All Kübler encoders come standard with six channels where A leads B in the clockwise direction and the standard index is gated with A & B. The tolerance of the wave form affects the control and, in some cases, may affect the smoothness of system operation.

#### Wave form tolerances



| <b>A leads B</b><br>when the shaft is rotated in the clockwise direction viewing the shaft or collet end.<br>This is the Kübler standard.<br>This format applies to the pin key codes listed below. |                                                                       | <b>B leads A</b><br>when the shaft is rotated in the clockwise direction viewing the shaft or collet end.<br>This format applies to the pin key codes listed below. |                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Order code ①                                                                                                                                                                                        |                                                                       | Order code ①                                                                                                                                                        |                                                         |
|                                                                                                                                                                                                     | Z gated with A & B.<br>This is the Kübler standard.<br>Z is 90° wide. | 04                                                                                                                                                                  | Z gated with A & B.<br>Z is 90° wide.                   |
| 01                                                                                                                                                                                                  | Z gated with B.<br>Z is 180° wide.                                    | 05                                                                                                                                                                  | Z gated with B.<br>Z is 180° wide.                      |
| 02                                                                                                                                                                                                  | Z gated with A.<br>Z is 180° wide.                                    | 06                                                                                                                                                                  | Z gated with A.<br>Z is 180° wide.                      |
| 03                                                                                                                                                                                                  | Z ungated.<br>Z is 330° to 360° wide.                                 | 07                                                                                                                                                                  | Z ungated.<br>Z is 330° to 360° wide.                   |
| 08                                                                                                                                                                                                  | Z is 180° wide                                                        | 09                                                                                                                                                                  | Z gated with $\bar{B}$ .<br>Z is 180° wide.             |
| 11                                                                                                                                                                                                  | Z is a minimum width of 270° (electrical degrees).                    | 10                                                                                                                                                                  | Z is a negative marker gated with B.<br>Z is 180° wide. |
| 13                                                                                                                                                                                                  | Z gated with $\bar{B}$ .<br>Z is 180° wide.                           | 12                                                                                                                                                                  | Z has a minimum width of 270°.                          |

# Incremental encoders

## Standard optical

Sendix 5000 / 5020 (shaft / hollow shaft)

Push-pull / RS422 / Open collector

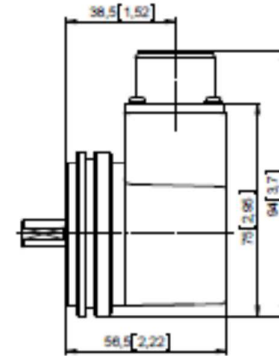
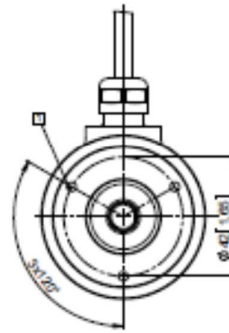
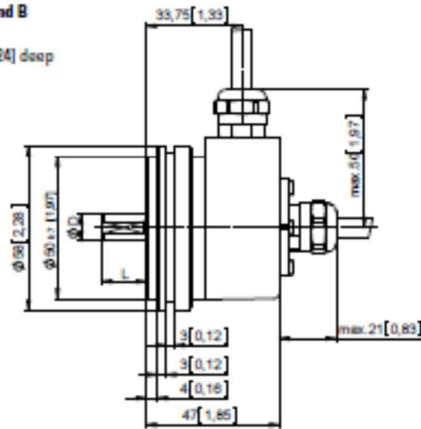
### Dimensions shaft version

Dimensions in mm [inch]

#### Synchro flange, $\varnothing 58$ [2.28]

##### Flange type A and B

□ 3 x M4, 6 [0.24] deep

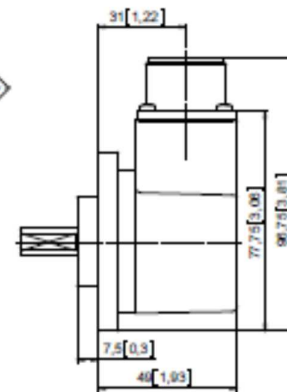
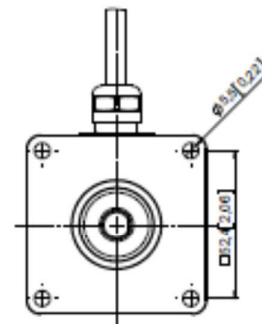
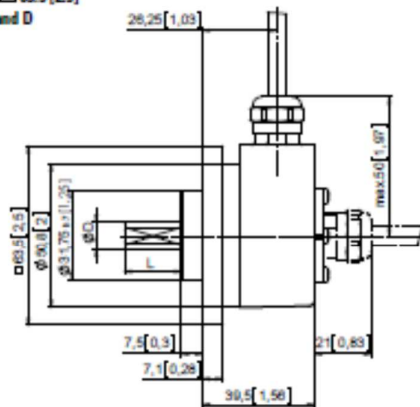


MIL-connector version

| D         | Fit | L         |
|-----------|-----|-----------|
| 6 [0.24]  | h7  | 10 [0.39] |
| 8 [0.32]  | h7  | 15 [0.59] |
| 10 [0.39] | h7  | 20 [0.79] |
| 12 [0.47] | h7  | 20 [0.79] |
| 1/4"      | h7  | 5/8"      |
| 3/8"      | h7  | 5/8"      |
| 1/4"      | h8  | 7/8"      |
| 3/8"      | h8  | 7/8"      |

#### Square flange, $\square 63.5$ [2.5]

##### Flange type C and D



MIL-connector version

| D         | Fit | L         |
|-----------|-----|-----------|
| 6 [0.24]  | h7  | 10 [0.39] |
| 8 [0.32]  | h7  | 15 [0.59] |
| 10 [0.39] | h7  | 20 [0.79] |
| 12 [0.47] | h7  | 20 [0.79] |
| 1/4"      | h7  | 5/8"      |
| 3/8"      | h7  | 5/8"      |
| 1/4"      | h8  | 7/8"      |
| 3/8"      | h8  | 7/8"      |