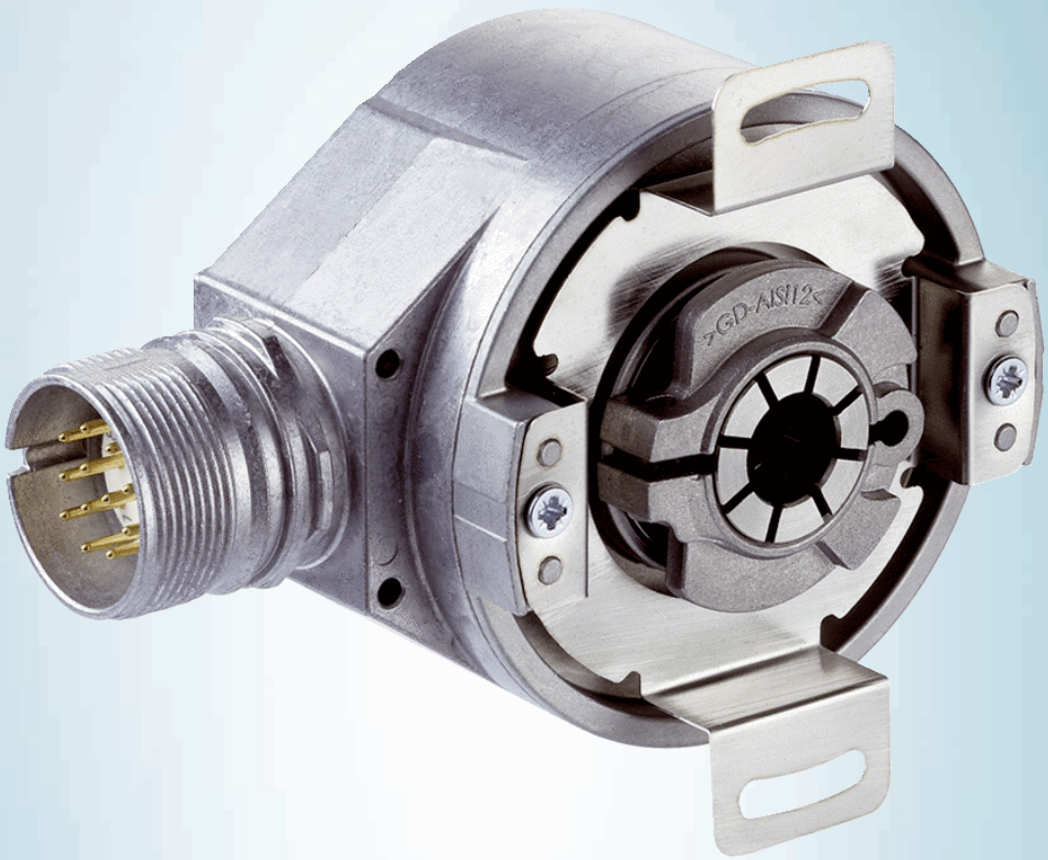
Product data sheet



# DFS60B-BFAA04096

## DFS60

INCREMENTAL ENCODERS

SICK
Sensor Intelligence.

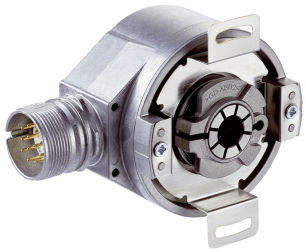


Illustration may differ

## Ordering information

| Type | Part no. |
|---|---|
| DFS60B-BFAA04096 | 1063727 |

Other models and accessories ➜ www.sick.com/DFS60

## Detailed technical data

### Performance

| | |
|---|---|
| **Pulses per revolution** | 4,096 [1] |
| **Measuring step** | 90° electronically/ppr |
| **Measuring step deviation at binary number of lines** | ± 0.008° |
| **Error limits** | ± 0.05° |

[1] See maximum revolution range.

### Interfaces

| | |
|---|---|
| **Communication interface** | Incremental |
| **Communication Interface detail** | TTL / RS-422 |
| **Number of signal channels** | 6-channel |
| **Initialization time** | 40 ms |
| **Output frequency** | ≤ 600 kHz |
| **Load current** | ≤ 30 mA |
| **Operating current** | 40 mA (without load) |

### Electrical data

| | |
|---|---|
| **Connection type** | Male connector, M23, 12-pin, radial |
| **Supply voltage** | 4.5 ... 5.5 V |
| **Reference signal, number** | 1 |
| **Reference signal, position** | 90°, electric, logically gated with A and B |
| **Short-circuit protection of the outputs** | ✓ [1] |
| **MTTFd: mean time to dangerous failure** | 300 years (EN ISO 13849-1) [2] |

[1] Short-circuit opposite to another channel, US or GND permissable for maximum 30 s.

[2] This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40 °C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

### Mechanical data

| | |
|---|---|
| **Mechanical design** | Blind hollow shaft |

[1] Allow for self-heating of 3.3 K per 1,000 rpm when designing the operating temperature range.

| | |
|---|---|
| **Shaft diameter** | 1/2″ |
| **Weight** | + 0.2 kg |
| **Shaft material** | Stainless steel |
| **Flange material** | Aluminum |
| **Housing material** | Aluminum die cast |
| **Start up torque** | 0.8 Ncm (+20 °C) |
| **Operating torque** | 0.6 Ncm (+20 °C) |
| **Permissible shaft movement, axial static/dynamic** | ± 0.5 mm / ± 0.2 mm |
| **Permissible shaft movement, radial static/dynamic** | ± 0.3 mm / ± 0.1 mm |
| **Operating speed** | ≤ 6,000 $min^{-1}$ [1] |
| **Moment of inertia of the rotor** | 40 $gcm^2$ |
| **Bearing lifetime** | 3.6 x 10^10 revolutions |
| **Angular acceleration** | ≤ 500,000 $rad/s^2$ |

[1] Allow for self-heating of 3.3 K per 1,000 rpm when designing the operating temperature range.

## Ambient data

| | |
|---|---|
| **EMC** | According to EN 61000-6-2 and EN 61000-6-3 |
| **Enclosure rating** | IP67, housing side, male connector connection (according to IEC 60529) [1]<br>IP65, shaft side (according to IEC 60529) |
| **Permissible relative humidity** | 90 % (condensation of the optical scanning not permitted) |
| **Operating temperature range** | –40 °C ... +100 °C [2]<br>–30 °C ... +100 °C [3] |
| **Storage temperature range** | –40 °C ... +100 °C, without package |
| **Resistance to shocks** | 70 g, 6 ms (according to EN 60068-2-27) |
| **Resistance to vibration** | 30 g, 10 Hz ... 2,000 Hz (according to EN 60068-2-6) |

[1] With mating connector fitted.
[2] Stationary position of the cable.
[3] Flexible position of the cable.

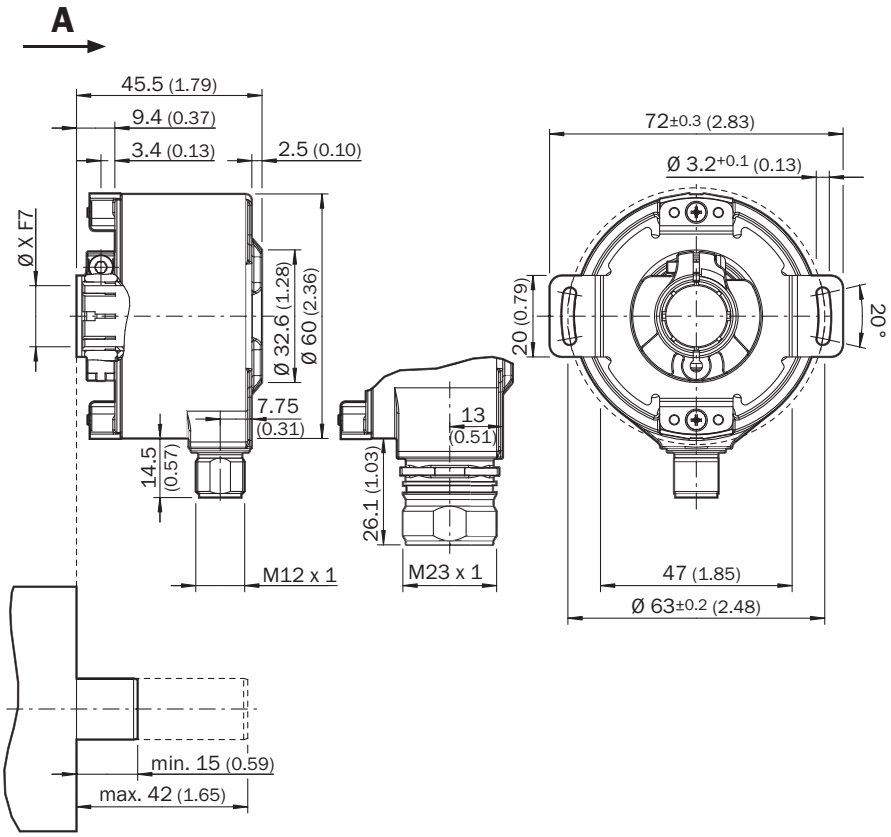
## Classifications

| | |
|---|---|
| **ECl@ss 5.0** | 27270501 |
| **ECl@ss 5.1.4** | 27270501 |
| **ECl@ss 6.0** | 27270590 |
| **ECl@ss 6.2** | 27270590 |
| **ECl@ss 7.0** | 27270501 |
| **ECl@ss 8.0** | 27270501 |
| **ECl@ss 8.1** | 27270501 |
| **ECl@ss 9.0** | 27270501 |
| **ECl@ss 10.0** | 27270501 |
| **ECl@ss 11.0** | 27270501 |
| **ETIM 5.0** | EC001486 |
| **ETIM 6.0** | EC001486 |

| | |
|---|---|
| **ETIM 7.0** | EC001486 |
| **UNSPSC 16.0901** | 41112113 |

## Dimensional drawing (Dimensions in mm (inch))

Blind hollow shaft, radial plug connection M12 and M23



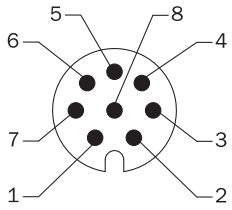

General tolerances according to DIN ISO 2768-mk

| Type<br>Blind hollow shaft | Shaft diameter XF7 | Shaft diameter xj7 |
|---|---|---|
| DFS60x-BAxxxxxxxx | 6 mm | Provided by customer |
| DFS60x-BBxxxxxxxx | 8 mm | |
| DFS60x-BCxxxxxxxx | 3/8" | |
| DFS60x-BDxxxxxxxx | 10 mm | |
| DFS60x-BExxxxxxxx | 12 mm | |
| DFS60x-BFxxxxxxxx | 1/2″ | |
| DFS60x-BGxxxxxxxx | 14 mm | |
| DFS60x-BHxxxxxxxx | 15 mm | |
| DFS60x-BJxxxxxxxx | 5/8″ | |

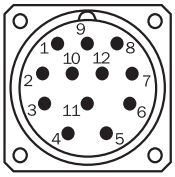
## PIN assignment

### Cable, 8-wire

View of M12 male device connector on encoder




View of M23 male device connector on encoder

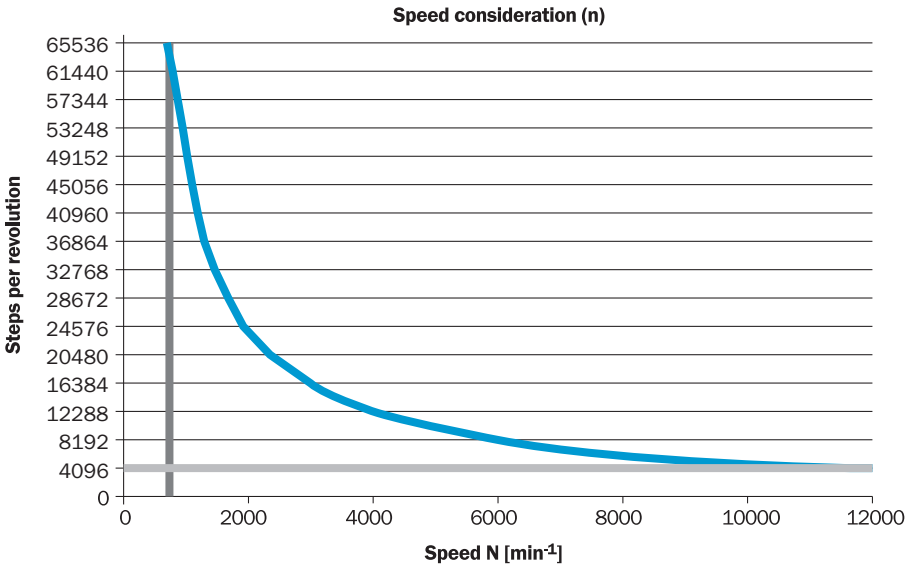



| PIN, 8-pin, M12 male connector | PIN, 12-pin, M23 male connector | Color of the wires for encoders with cable outlet | TTL/HTL signal | Sin/cos 1.0 $V_{ss}$ | Explanation |
|---|---|---|---|---|---|
| 1 | 6 | Brown | $\overline{A}$ | COS– | Signal wire |
| 2 | 5 | White | A | COS+ | Signal wire |
| 3 | 1 | Black | $\overline{B}$ | SIN– | Signal wire |
| 4 | 8 | Pink | B | SIN+ | Signal wire |
| 5 | 4 | Yellow | $\overline{Z}$ | $\overline{Z}$ | Signal wire |
| 6 | 3 | Violet | Z | Z | Signal wire |
| 7 | 10 | Blue | GND | GND | Ground connection of the encoder |
| 8 | 12 | Red | $+U_S$ | $+U_S$ | Supply voltage (volt-free to housing) |
| – | 9 | – | n.c. | n.c. | Not assigned |
| – | 2 | – | n.c. | n.c. | Not assigned |
| – | 11 | – | n.c. | n.c. | Not assigned |
| – | 7 [1] | – | 0-SET [1] | n.c. | Set zero pulse [1] |
| Screen | Screen | Screen | Screen | Screen | Screen connected to housing on encoder side.<br>Connected to ground on control side. |

[1] For electrical interfaces only: M, U, V, W with 0-SET function on PIN 7 on M23 male connector. The 0-SET input is used to set the zero pulse on the current shaft position. If the 0-SET input is connected to $U_S$ for longer than 250 ms after it had previously been unassigned for at least 1,000 ms or had been connected to the GND, the current position of the shaft is assigned to the zero pulse signal “Z”.

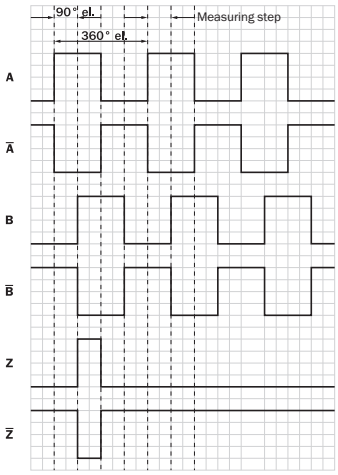
## Maximum revolution range

Maximum revolution range




## Signal outputs

Signal outputs




CW with view on the encoder shaft in direction “A”, compare dimensional drawing.

| Supply voltage | Output |
|---|---|
| 4,5 V ... 5,5 V | TTL |
| 10 V ... 32 V | TTL |
| 10 V ... 32 V | HTL |

## Recommended accessories

Other models and accessories ➜ www.sick.com/DFS60

| | Brief description | Type | Part no. |
|---|---|---|---|
| **Flanges** | | | |
|  | Standard stator coupling | BEF-DS00XFX | 2056812 |
| **Other mounting accessories** | | | |
|  | Clamping ring for metal hollow shaft, metal | BEF-KR-M | 2064709 |
| **Plug connectors and cables** | | | |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 2 m | DOL-2312-G02MLA3 | 2030682 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 3 m | DOL-2312-G03MMA3 | 2029213 |
| | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 5 m | DOL-2312-G05MMA3 | 2029214 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 7 m | DOL-2312-G07MLA3 | 2030685 |
| | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 10 m | DOL-2312-G10MLA3 | 2030688 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 10 m | DOL-2312-G10MMA3 | 2029215 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 15 m | DOL-2312-G15MLA3 | 2030692 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 1.5 m | DOL-2312-G1M5MA3 | 2029212 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 20 m | DOL-2312-G20MLA3 | 2030695 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 20 m | DOL-2312-G20MMA3 | 2029216 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 25 m | DOL-2312-G25MLA3 | 2030699 |
| | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 30 m | DOL-2312-G30MLA3 | 2030702 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 30 m | DOL-2312-G30MMA3 | 2029217 |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: -<br>Cable: HIPERFACE®, SSI, Incremental, shielded | DOS-2312-G02 | 2077057 |

| | Brief description | Type | Part no. |
|---|---|---|---|
|  | Head A: female connector, M23, 12-pin, angled<br>Head B: -<br>Cable: HIPERFACE®, SSI, Incremental, shielded | DOS-2312-W01 | 2072580 |

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We have extensive experience in a wide range of industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services complete our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

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