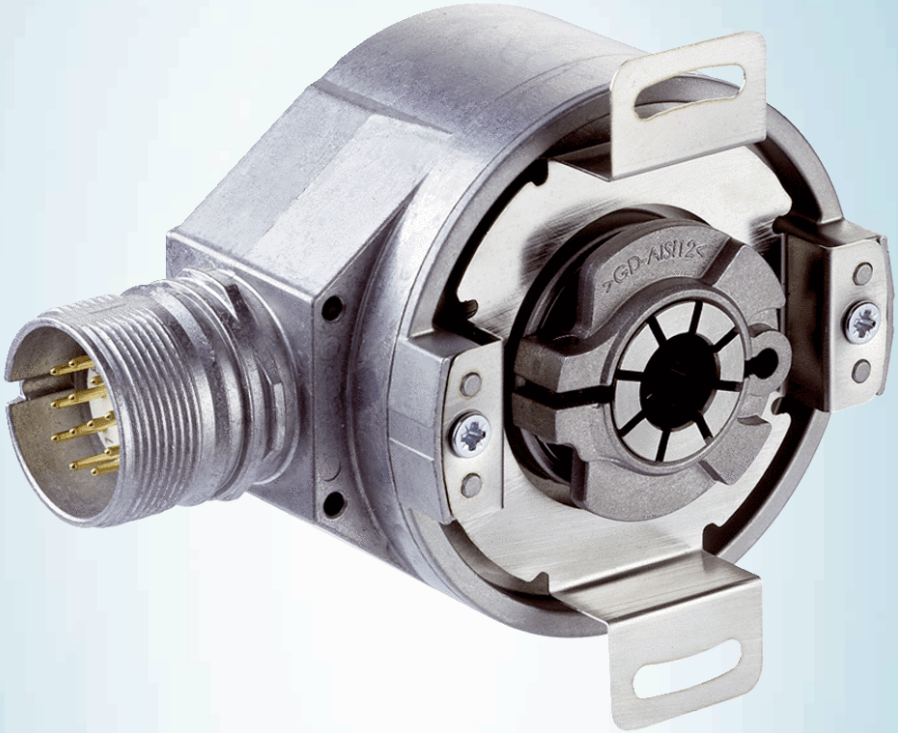
Data sheet



# DFS60B-BANA01024

## DFS60

INCREMENTAL ENCODERS

SICK
Sensor Intelligence.

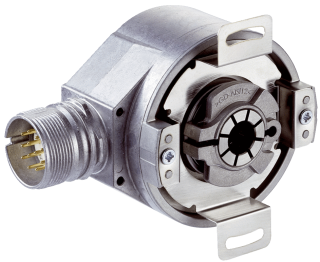


Illustration may differ

## Ordering information

| Type | part no. |
|---|---|
| DFS60B-BANA01024 | 1076861 |

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

## Detailed technical data

### Safety-related parameters

| | |
|---|---|
| **$MTTF_D$ (mean time to dangerous failure)** | 300 years (EN ISO 13849-1) [1] |

[1] 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.

### Performance

| | |
|---|---|
| **Sine/cosine periods per revolution** | 1,024 |
| **Measuring step** | 90°, electric/pulses per revolution |
| **Measuring step deviation at binary number of lines** | ± 0.008° |
| **Error limits** | ± 0.05° |

### Interfaces

| | |
|---|---|
| **Communication interface** | Incremental |
| **Communication Interface detail** | Sin/Cos [1] |
| **Number of signal channels** | 6-channel |
| **Initialization time** | 40 ms |
| **Output frequency** | ≤ 200 kHz |
| **Operating current** | 40 mA (without load) |
| **Load resistance** | ≤ 120 Ω |

[1] 1.0 $V_{SS}$ (differential).

### Electronics

| | |
|---|---|
| **Connection type** | Male connector, M23, 12-pin, radial |
| **Supply voltage** | 4.5 ... 5.5 V |
| **Reference signal, number** | 1 |
| **Reference signal, position** | 90°, electronically, gated with Sinus and Cosinus |
| **Short-circuit protection of the outputs** | ✓ [1] |

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

## Mechanics

| | |
|---|---|
| **Mechanical design** | Blind hollow shaft |
| **Shaft diameter** | 6 mm<br>Front clamp |
| **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 movement static** | ± 0.3 mm (radial)<br>± 0.5 mm (axial) |
| **Permissible movement dynamic** | ± 0.1 mm (radial)<br>± 0.2 mm (axial) |
| **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 (IEC 60529) [1]<br>IP65, shaft side (IEC 60529) |
| **Permissible relative humidity** | 90 % (Condensation 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 (EN 60068-2-27) |
| **Resistance to vibration** | 30 g, 10 Hz ... 2,000 Hz (EN 60068-2-6) |

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

## Certificates

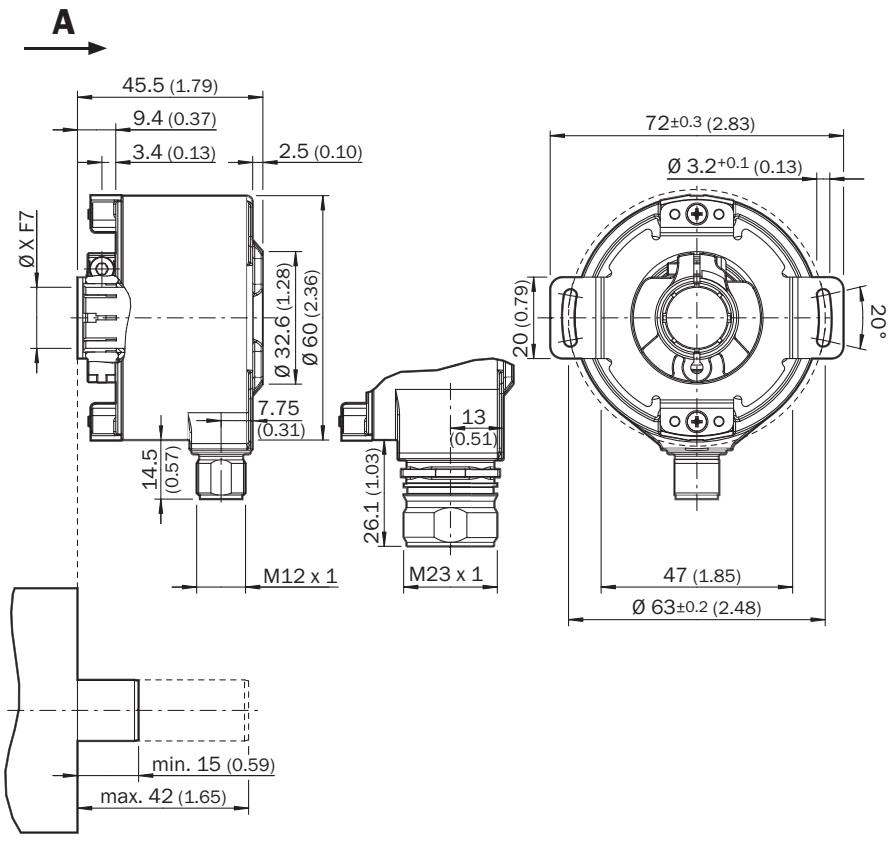
| | |
|---|---|
| **EU declaration of conformity** | ✓ |
| **UK declaration of conformity** | ✓ |
| **ACMA declaration of conformity** | ✓ |
| **Moroccan declaration of conformity** | ✓ |
| **China RoHS** | ✓ |
| **cULus certificate** | ✓ |
| **Information according to Art. 3 of Data Act (Regulation EU 2023/2854)** | ✓ |

## Classifications

| | |
|---|---|
| **ECLASS 5.0** | 27270501 |

| | |
|---|---|
| **ECLASS 5.1.4** | 27270501 |
| **ECLASS 6.0** | 27270590 |
| **ECLASS 6.2** | 27270590 |
| **ECLASS 7.0** | 27270501 |
| **ECLASS 8.0** | 27270501 |
| **ECLASS 8.1** | 27270501 |
| **ECLASS 9.0** | 27270501 |
| **ECLASS 10.0** | 27270501 |
| **ECLASS 11.0** | 27270501 |
| **ECLASS 12.0** | 27270501 |
| **ETIM 5.0** | EC001486 |
| **ETIM 6.0** | EC001486 |
| **ETIM 7.0** | EC001486 |
| **ETIM 8.0** | EC001486 |
| **UNSPSC 16.0901** | 41112113 |

## Dimensional drawing Blind hollow shaft, radial male connector M12 and M23

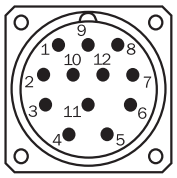



Dimensions in mm (inch)
General tolerances according to DIN ISO 2768-mk

| TypeBlind hollow shaft | Shaft diameter XF7 | Shaft diameter xj7 |
|---|---|---|
| DFS60x-BAxxxxxxxx | 6 mm | Provided by customer |

| TypeBlind hollow shaft | Shaft diameter XF7 | Shaft diameter xj7 |
|---|---|---|
| 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

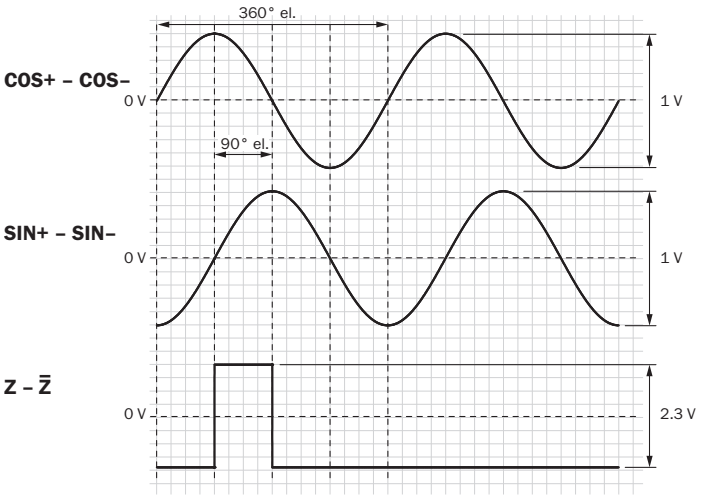



view of M23 male device connector on encoder

| PINMale connector M12, 8-pin | PINMale connector M23, 12-pin | Wire colors (cable connection) | TTL/HTL signal | Sin/Cos 1.0 $V_{PP}$ | 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 | Purple | Z | Z | Signal wire |
| 7 | 10 | Blue | GND | GND | Ground connection |
| 8 | 12 | Red | $+U_S$ | $+U_S$ | Supply voltage |
| - | 9 | - | N.c. | N.c. | Not assigned |
| - | 2 | - | N.c. | N.c. | Not assigned |
| - | 11 | - | N.c. | N.c. | Not assigned |
| - | 7 [1)] | Orange | 0-SET [1)] | N.c. | Set zero pulse[1)] |
| Screen | Screen | Screen | Screen | Screen | Screen connected to housing on encoder side. Connected to ground on control side. |

[1)] For electrical interfaces only: M, U, V, W with 0-SET function on PIN 7 on M23 plug. The 0-SET input is used to set the zero pulse to the current shaft position. If the 0-SET input is applied to US for longer than 250 ms after it has previously been open or applied to GND for at least 1,000 ms, the current shaft position is assigned zero pulse signal “Z”.

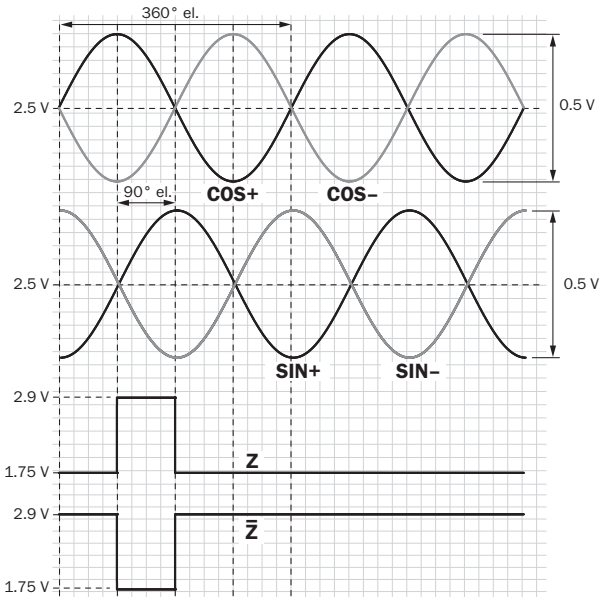
## Diagrams Signal SIN/COS after differential generation




For clockwise shaft rotation, looking in direction “A” (see dimensional drawing)

| Supply voltage | Output |
|---|---|
| 4,5 V ... 5,5 V | Sin/Cos 1.0 $V_{PP}$ |

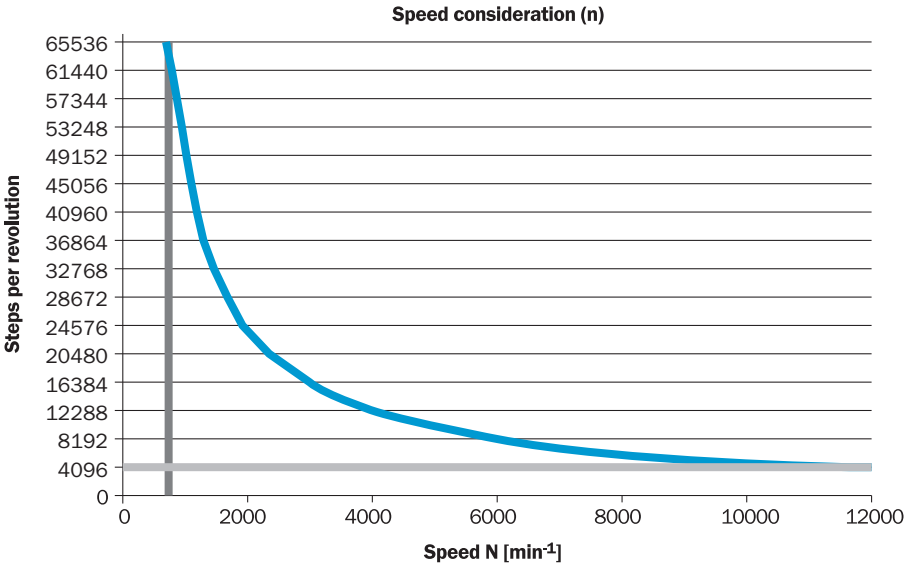
## Diagrams Signal SIN/COS before differential generation




For clockwise shaft rotation, looking in direction “A” (see dimensional drawing)

| Signal | Interface signals | Signal before differential generationAt load 120 Ω | Signal offset |
|---|---|---|---|
| + SIN- SIN+ COS- COS | Analog, differential | 0,5 $V_{SS}$ ± 20 % | 2,5 V ± 10 % |
| ZZ_ | Digital differential | Low: 1,75 V ± 15 %,<br>High: 2,90 V ± 15 % | – |

## maximum revolution range




## Recommended accessories

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

| | Brief description | Type | part no. |
|---|---|---|---|
| Mounting systems | | | |
| | • **Product family:** Stator couplings<br>• **Description:** Standard stator coupling | BEF-DS00XFX | 2056812 |
| | • **Description:** Clamping ring for metal hollow shaft<br>• **Material:** Steel<br>• **Details:** Metal | BEF-KR-M | 2064709 |

| | Brief description | Type | part no. |
|---|---|---|---|
| connectors and cables | | | |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 2 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G02MLA3 | 2030682 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 7 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G07MLA3 | 2030685 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 10 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G10MLA3 | 2030688 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 15 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G15MLA3 | 2030692 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 20 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G20MLA3 | 2030695 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 25 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G25MLA3 | 2030699 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 30 m, 11-wire, PUR<br>• **Application:** Zones with oils and lubricants | DOL-2312-G30MLA3 | 2030702 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 1.5 m, 12-wire, PUR, halogen-free<br>• **Application:** Zones with oils and lubricants | DOL-2312-G1M5MA3 | 2029212 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 3 m, 12-wire, PUR, halogen-free<br>• **Application:** Zones with oils and lubricants | DOL-2312-G03MMA3 | 2029213 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 5 m, 12-wire, PUR, halogen-free<br>• **Application:** Zones with oils and lubricants | DOL-2312-G05MMA3 | 2029214 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 10 m, 12-wire, PUR, halogen-free | DOL-2312-G10MMA3 | 2029215 |

| | Brief description | Type | part no. |
|---|---|---|---|
| | • **Application:** Zones with oils and lubricants | | |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 20 m, 12-wire, PUR, halogen-free<br>• **Application:** Zones with oils and lubricants | DOL-2312-G20MMA3 | 2029216 |
| | • **Description:** Incremental, shielded<br>• **Connection type head A:** Female connector, M23, 12-pin, straight<br>• **Connection type head B:** Flying leads<br>• **Signal type:** Incremental<br>• **Cable:** 30 m, 12-wire, PUR, halogen-free<br>• **Application:** Zones with oils and lubricants | DOL-2312-G30MMA3 | 2029217 |
| | • **Description:** HIPERFACE®, shielded, SSI, Incremental<br>• **Connection type head A:** Female connector, M23, 12-pin, straight, A-coded<br>• **Signal type:** HIPERFACE®, SSI, Incremental<br>• **Connection systems:** Solder connection | DOS-2312-G02 | 2077057 |
|  | • **Description:** HIPERFACE®, shielded, SSI, Incremental<br>• **Connection type head A:** Female connector, M23, 12-pin, angled, A-coded<br>• **Signal type:** HIPERFACE®, SSI, Incremental<br>• **Connection systems:** Solder connection | DOS-2312-W01 | 2072580 |

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