



# DFS60E-BHAA02048

DFS60

INCREMENTAL ENCODERS

**SICK**  
Sensor Intelligence.



Illustration may differ



### Ordering information

Type	Part no.
DFS60E-BHAA02048	1056928

Other models and accessories → [www.sick.com/DFS60](http://www.sick.com/DFS60)

### Detailed technical data

#### Safety-related parameters

<b>MTTF<sub>D</sub> (mean time to dangerous failure)</b>	300 years (EN ISO 13849-1) <sup>1)</sup>
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<sup>1)</sup> 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

<b>Pulses per revolution</b>	2,048 <sup>1)</sup>
<b>Measuring step</b>	90°, electric/pulses per revolution
<b>Measuring step deviation at binary number of lines</b>	± 0.15°
<b>Error limits</b>	± 0.3°

<sup>1)</sup> See maximum revolution range.

#### Interfaces

<b>Communication interface</b>	Incremental
<b>Communication Interface detail</b>	TTL / RS-422
<b>Number of signal channels</b>	6-channel
<b>Initialization time</b>	40 ms
<b>Output frequency</b>	≤ 300 kHz
<b>Load current</b>	≤ 30 mA
<b>Operating current</b>	40 mA (without load)

#### Electronics

<b>Connection type</b>	Male connector, M23, 12-pin, radial
<b>Supply voltage</b>	4.5 ... 5.5 V
<b>Reference signal, number</b>	1
<b>Reference signal, position</b>	90°, electric, logically gated with A and B
<b>Short-circuit protection of the outputs</b>	✓ <sup>1)</sup>

<sup>1)</sup> Short-circuit opposite to another channel, US or GND permissible for maximum 30 s.

## Mechanics

<b>Mechanical design</b>	Blind hollow shaft
<b>Shaft diameter</b>	15 mm
<b>Weight</b>	+ 0.2 kg
<b>Shaft material</b>	Stainless steel
<b>Flange material</b>	Aluminum
<b>Housing material</b>	Aluminum die cast
<b>Start up torque</b>	0.8 Ncm (+20 °C)
<b>Operating torque</b>	0.6 Ncm (+20 °C)
<b>Permissible movement static</b>	± 0.3 mm (radial) ± 0.5 mm (axial)
<b>Permissible movement dynamic</b>	± 0.1 mm (radial) ± 0.2 mm (axial)
<b>Operating speed</b>	≤ 6,000 min <sup>-1</sup> <sup>1)</sup>
<b>Moment of inertia of the rotor</b>	40 gcm <sup>2</sup>
<b>Bearing lifetime</b>	3.6 x 10 <sup>10</sup> revolutions
<b>Angular acceleration</b>	≤ 500,000 rad/s <sup>2</sup>

<sup>1)</sup> Allow for self-heating of 3.3 K per 1,000 rpm when designing the operating temperature range.

## Ambient data

<b>EMC</b>	According to EN 61000-6-2 and EN 61000-6-3
<b>Enclosure rating</b>	IP67, Housing side, male connector (IEC 60529) <sup>1)</sup> IP65, shaft side (IEC 60529)
<b>Permissible relative humidity</b>	90 % (Condensation not permitted)
<b>Operating temperature range</b>	0 °C ... +85 °C
<b>Storage temperature range</b>	-40 °C ... +100 °C, without package
<b>Resistance to shocks</b>	50 g, 6 ms (EN 60068-2-27)
<b>Resistance to vibration</b>	20 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)

<sup>1)</sup> With mating connector fitted.

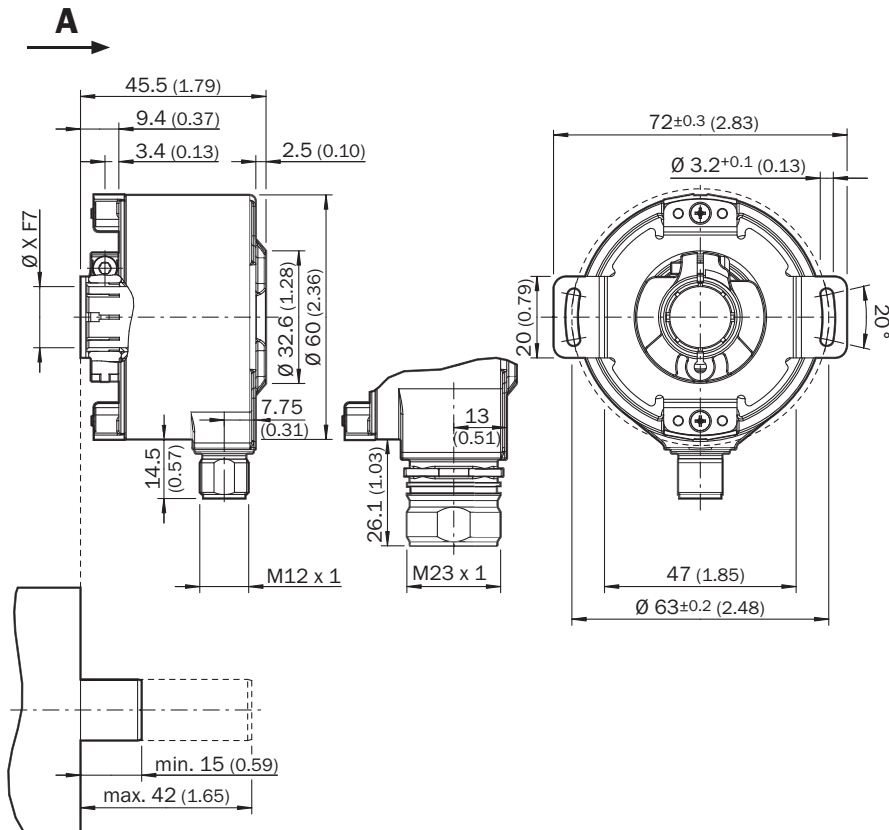
## Classifications

<b>ECLASS 5.0</b>	27270501
<b>ECLASS 5.1.4</b>	27270501
<b>ECLASS 6.0</b>	27270590
<b>ECLASS 6.2</b>	27270590
<b>ECLASS 7.0</b>	27270501
<b>ECLASS 8.0</b>	27270501
<b>ECLASS 8.1</b>	27270501
<b>ECLASS 9.0</b>	27270501
<b>ECLASS 10.0</b>	27270501
<b>ECLASS 11.0</b>	27270501
<b>ECLASS 12.0</b>	27270501
<b>ETIM 5.0</b>	EC001486

<b>ETIM 6.0</b>	EC001486
<b>ETIM 7.0</b>	EC001486
<b>ETIM 8.0</b>	EC001486
<b>UNSPSC 16.0901</b>	41112113

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

Blind hollow shaft, radial male connector M12 and M23



General tolerances according to DIN ISO 2768-mk

Type	Shaft diameter XF7	Shaft diameter xj7
<b>Blind hollow shaft</b>		
DFS60x-BAxxxxxxx	6 mm	Provided by customer
DFS60x-BBxxxxxxx	8 mm	
DFS60x-BCxxxxxxx	3/8"	
DFS60x-BDxxxxxxx	10 mm	
DFS60x-BExxxxxxx	12 mm	
DFS60x-BFxxxxxxx	1/2"	
DFS60x-BGxxxxxxx	14 mm	
DFS60x-BHxxxxxxx	15 mm	
DFS60x-BJxxxxxxx	5/8"	

## PIN assignment



View of M23 male device connector on encoder

PIN Male connector M12, 8-pin	PIN Male connector M23, 12-pin	Wire colors (cable connection)	TTL/HTL signal	Sin/Cos 1.0 V <sub>PP</sub>	Explanation
1	6	Brown	$\bar{A}$	COS-	Signal wire
2	5	White	A	COS+	Signal wire
3	1	Black	$\bar{B}$	SIN-	Signal wire
4	8	Pink	B	SIN+	Signal wire
5	4	Yellow	$\bar{Z}$	$\bar{Z}$	Signal wire
6	3	Purple	Z	Z	Signal wire
7	10	Blue	GND	GND	Ground connection
8	12	Red	+U <sub>S</sub>	+U <sub>S</sub>	Supply voltage
-	9	-	N.c.	N.c.	Not assigned
-	2	-	N.c.	N.c.	Not assigned
-	11	-	N.c.	N.c.	Not assigned
-	7 <sup>1)</sup>	Orange	0-SET <sup>1)</sup>	N.c.	Set zero pulse <sup>1)</sup>
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 outputs



CW with view on the encoder shaft in direction "A", compare dimensional drawing.  
Maximum revolution range



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](http://www.sick.com/DFS60)

	Brief description	Type	Part no.
Flanges			
	<ul style="list-style-type: none"> <li><b>Description:</b> Standard stator coupling</li> </ul>	BEF-DS00XFX	2056812
Other mounting accessories			
	<ul style="list-style-type: none"> <li><b>Description:</b> Clamping ring for metal hollow shaft<sup>1)</sup></li> <li><b>Details:</b> Metal</li> </ul>	BEF-KR-M	2064709
Others			
	<ul style="list-style-type: none"> <li><b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li><b>Connection type head B:</b> Flying leads</li> <li><b>Signal type:</b> Incremental</li> <li><b>Cable:</b> 2 m, 11-wire, PUR</li> <li><b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G02MLA3	2030682
	<ul style="list-style-type: none"> <li><b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li><b>Connection type head B:</b> Flying leads</li> <li><b>Signal type:</b> Incremental</li> <li><b>Cable:</b> 7 m, 11-wire, PUR</li> <li><b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G07MLA3	2030685
	<ul style="list-style-type: none"> <li><b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li><b>Connection type head B:</b> Flying leads</li> <li><b>Signal type:</b> Incremental</li> <li><b>Cable:</b> 10 m, 11-wire, PUR</li> <li><b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G10MLA3	2030688
	<ul style="list-style-type: none"> <li><b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li><b>Connection type head B:</b> Flying leads</li> <li><b>Signal type:</b> Incremental</li> <li><b>Cable:</b> 15 m, 11-wire, PUR</li> <li><b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G15MLA3	2030692
	<ul style="list-style-type: none"> <li><b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li><b>Connection type head B:</b> Flying leads</li> <li><b>Signal type:</b> Incremental</li> <li><b>Cable:</b> 20 m, 11-wire, PUR</li> <li><b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G20MLA3	2030695
	<ul style="list-style-type: none"> <li><b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li><b>Connection type head B:</b> Flying leads</li> <li><b>Signal type:</b> Incremental</li> <li><b>Cable:</b> 25 m, 11-wire, PUR</li> <li><b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G25MLA3	2030699

	Brief description	Type	Part no.
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 30 m, 11-wire, PUR</li> <li>• <b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G30MLA3	2030702
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 1.5 m, 12-wire, PUR, halogen-free</li> <li>• <b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: Cable Cable: incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G1M5MA3	2029212
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 3 m, 12-wire, PUR, halogen-free</li> <li>• <b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: Cable Cable: incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G03MMA3	2029213
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 5 m, 12-wire, PUR, halogen-free</li> <li>• <b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: Cable Cable: incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G05MMA3	2029214
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 10 m, 12-wire, PUR, halogen-free</li> <li>• <b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: Cable Cable: incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G10MMA3	2029215
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 20 m, 12-wire, PUR, halogen-free</li> <li>• <b>Description:</b> Incremental, shielded, Head A: Female connector, M23, 12-pin, straight Head B: Cable Cable: Incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G20MMA3	2029216
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> 30 m, 12-wire, PUR, halogen-free</li> <li>• <b>Description:</b> Incremental, shielded, Head A: female connector, M23, 12-pin, straight Head B: Cable Cable: incremental, suitable for drag chain, PUR, halogen-free, shielded, 4 x 2 x 0.25 mm<sup>2</sup> + 2 x 0.5 mm<sup>2</sup> + 1 x 0.14 mm<sup>2</sup>, Ø 7.8 mm</li> </ul>	DOL-2312-G30MMA3	2029217
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIAPERFACE<sup>®</sup>, SSI, Incremental</li> <li>• <b>Description:</b> HIAPERFACE<sup>®</sup>, SSI, Incremental, shielded, Head A: female connector, M23, 12-pin, straight, shielded, for cable diameter 5.5 mm ... 10.5 mm Head B: - Operating temperature: -40 °C ... +125 °C</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>	DOS-2312-G02	2077057
	<ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, angled, A-coded</li> <li>• <b>Signal type:</b> HIAPERFACE<sup>®</sup>, SSI, Incremental</li> <li>• <b>Description:</b> HIAPERFACE<sup>®</sup>, SSI, Incremental, shielded, Head A: female connector, M23, 12-pin, angled, shielded, for cable diameter 4.2 mm ... 6.6 mm Head B: - Operating temperature: -20 °C ... +130 °C</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>	DOS-2312-W01	2072580



## SICK AT A GLANCE

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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.

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For us, that is “Sensor Intelligence.”

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