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Product data sheet



DFS60S-THOA01024

DFS60S Pro

SAFETY ENCODERS

SICK
Sensor Intelligence.

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DFS60S-THOA01024 | DFS60S Pro

SAFETY ENCODERS



Illustration may differ

Ordering information

Type	Part no.
DFS60S-THOA01024	1077007

Other models and accessories → www.sick.com/DFS60S_Pro

Detailed technical data

Safety-related parameters

Safety integrity level	SIL2 (IEC 61508), SILCL2 (IEC 62061) [1]
Performance level	PL d (EN ISO 13849) [1]
Category	3 (EN ISO 13849)
PFH_D: Probability of dangerous failure per hour	1.7×10^{-8} [2]
T_M (mission time)	20 years (EN ISO 13849)
Safety-related measuring step	0.09°, Quadrature analysis
Safety-related accuracy	± 0.09°

[1] For more detailed information on the exact configuration of your machine/unit, please consult your relevant SICK branch office.

[2] The values displayed apply to a diagnostic degree of coverage of 99%, which must be achieved by the external drive system and 95 °C operating temperature.

Performance

Sine/cosine periods per revolution	1,024
Measuring step	0.3 ″, For interpolation of the sine/cosine signals with, e. g., 12 bits [1]
Initialization time	50 ms [2]
Integral non-linearity	Typ. ± 45 Winkelsekunden (without mechanical tension of the stator coupling)
Differential non-linearity	± 7 Winkelsekunden
Reference signal, number	1
Reference signal, position	90°, electronically, gated with Sinus and Cosinus

[1] Not safety-related.

[2] Valid signals can be read once this time has elapsed.

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Electrical data

Communication interface	Incremental
Communication Interface detail	Sin/Cos [1]
Connection type	Male connector, M23, 12-pin, radial
Supply voltage	4.5 V ... 32 V
Maximum output frequency	≤ 153.6 kHz
Load resistance	≥ 120 Ω
Power consumption max. without load	≤ 0.7 W
Power consumption	Without load
Reverse polarity protection	✓
Protection class	III (according to DIN EN 61140)
Short-circuit protection	✓ [2]

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

[2] Short-circuit to another channel or GND permitted for max. 30 s. In the case of U_S ≤ 12 V additional short-circuit to U_S permitted for max. 30 s.

Mechanical data

Mechanical design	Through hollow shaft with feather key groove
Shaft diameter	15 mm
Shaft material	Stainless steel
Flange material	Die-cast zinc
Housing material	Aluminum die cast
Weight	Approx. 0.25 kg [1]
Start up torque	≤ 0.8 Ncm (at 20 °C)
Operating torque	≤ 0.6 Ncm (at 20 °C)
Permissible movement static	± 0.3 mm (radial) ± 0.5 mm (axial)
Permissible movement dynamic	± 0.05 mm (radial) ± 0.1 mm (axial)
Max. angular acceleration	≤ 500,000 rad/s²
Operating speed	6,000 min^{-1} [2]
Moment of inertia of the rotor	56 gcm²
Bearing lifetime	3.6 x 10^9 revolutions [3]

[1] Based on encoder with male connector.

[2] Allow for self-heating of approx. 3.0 K per 1,000 rpm regarding the permissible operating temperature.

[3] On maximum operating speed and temperature.

Ambient data

EMC	According to EN 61000-6-2, EN 61000-6-3 and IEC 61326-3-1
Enclosure rating	IP65 (IEC 60529) [1]
Permissible relative humidity	90 %, Condensation not permitted

[1] With male connector and mating connector fitted minimum IP65.

[2] At operating temperature measuring point.

[3] Checked during operation using vector length monitoring.

[4] Checked to operation with vector length monitoring. Including mating connector.

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Operating temperature range	–30 °C ... +95 °C [2]
Storage temperature range	–30 °C ... +90 °C, without package
Resistance to shocks	100 g, 6 ms (according to EN 60068-2-27) [3]
Frequency range of resistance to vibrations	10 g, 10 Hz ... 1,000 Hz (EN 60068-2-6) [4]

[1] With male connector and mating connector fitted minimum IP65.
[2] At operating temperature measuring point.
[3] Checked during operation using vector length monitoring.
[4] Checked to operation with vector length monitoring. Including mating connector.

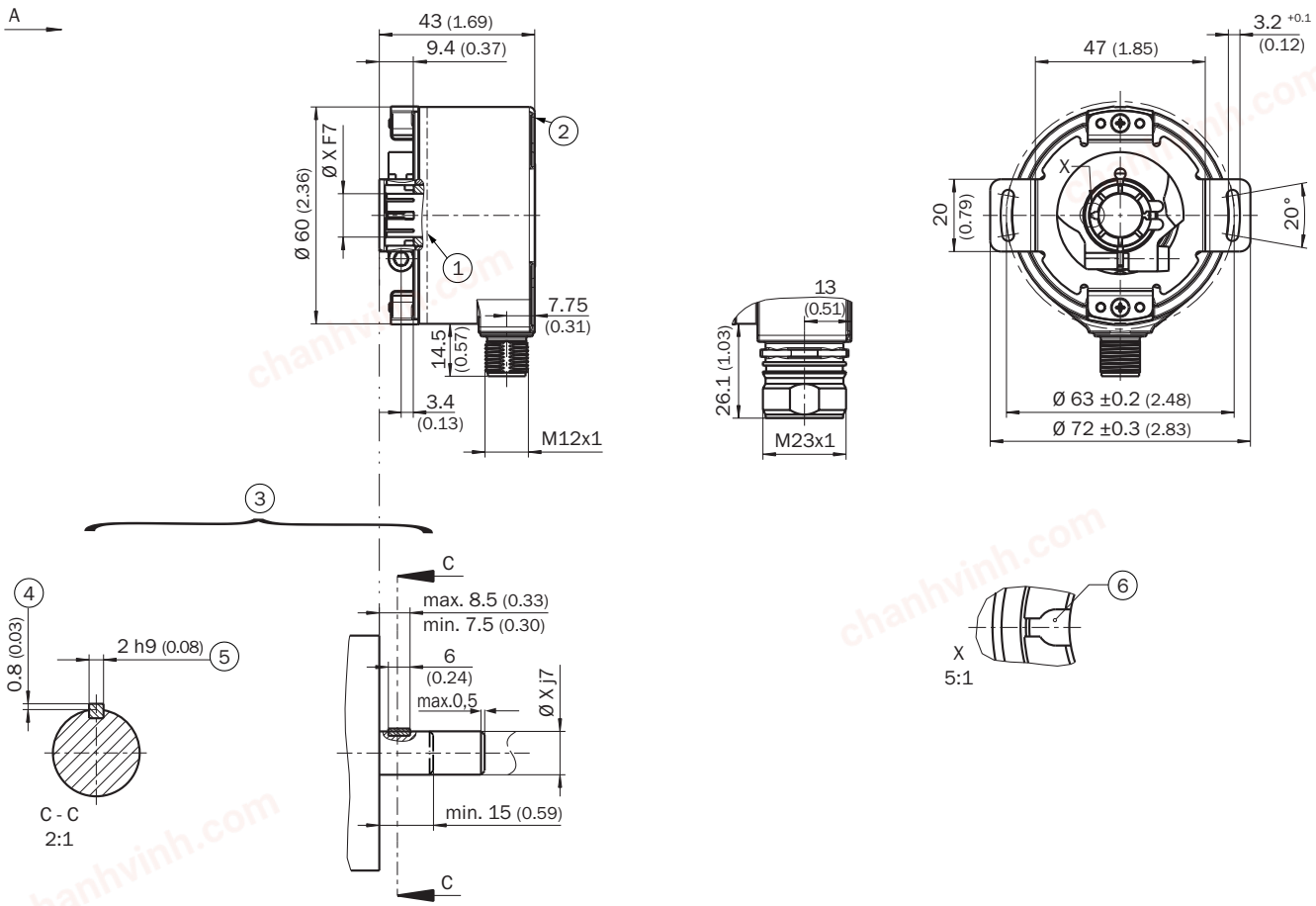
Classifications

eCl@ss 5.0	27272501
eCl@ss 5.1.4	27272501
eCl@ss 6.0	27272590
eCl@ss 6.2	27272590
eCl@ss 7.0	27272590
eCl@ss 8.0	27272590
eCl@ss 8.1	27272590
eCl@ss 9.0	27272590
eCl@ss 10.0	27270502
eCl@ss 11.0	27270502
eCl@ss 12.0	27270501
ETIM 5.0	EC001486
ETIM 6.0	EC001486
ETIM 7.0	EC001486
ETIM 8.0	EC001486
UNSPSC 16.0901	41112113

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Dimensional drawing (Dimensions in mm (inch))

Through hollow shaft, M12 and M23 radial male connector



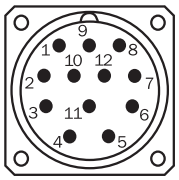
General tolerances according to DIN ISO 2768-mk

① Operating temperature measuring point (freely selectable, around the housing surface area in each case, approx. 3 mm away from flange)
② Measuring point vibration (respectively at the housing face. approx. 3 mm away from the cover edge)
③ Attachment specifications
④ Max. 0.4 at Ø 5/8"
⑤ Feather key DIN 6885-A 2x2x6
⑥ Feather key groove

Shaft diameter XF7	Shaft diameter xj7
6 mm	Provided by customer
8 mm	
3/8″	
10 mm	
12 mm	
1/2″	
14 mm	
15 mm	
5/8″	

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PIN assignment



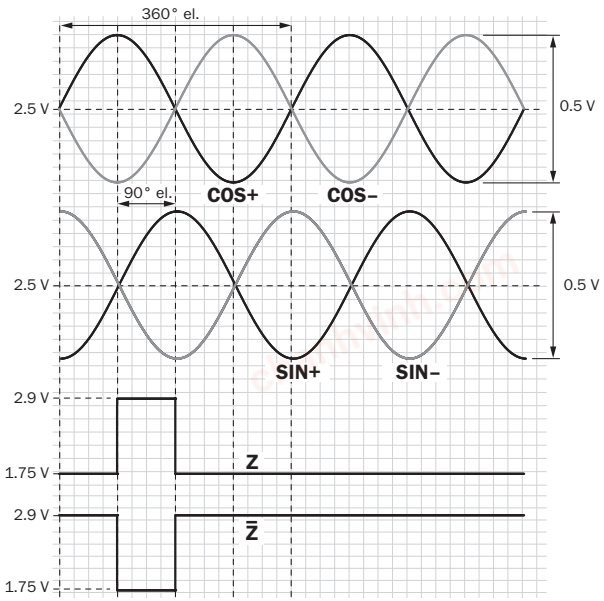
View of M23 male device connector on encoder

PIN Male connector M12, 8-pin	PIN Male connector M23, 12-pin	Wire colors (cable connection)	Signal	Explanation
1	6	Brown	- COS	Signal wire
2	5	White	+ COS	Signal wire
3	1	Black	- SIN	Signal wire
4	8	Pink	+ SIN	Signal wire
5	4	Yellow		Signal (do not use for safety operating mode)
6	3	Violet	Z	Signal (do not use for safety operating mode)
7	10	Blue	GND	Ground connection
8	12	Red	U_S	Supply voltage (volt-free to housing)
-	9	-	N.C.	Not assigned
-	2	-	N.C.	Not assigned
-	11	-	N.C.	Not assigned
-	7	-	N.C.	Not assigned
Screen	Screen	Screen	Screen	Screen connected to encoder housing Screen connected to housing on encoder side. Connected to ground on control side.

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Diagrams

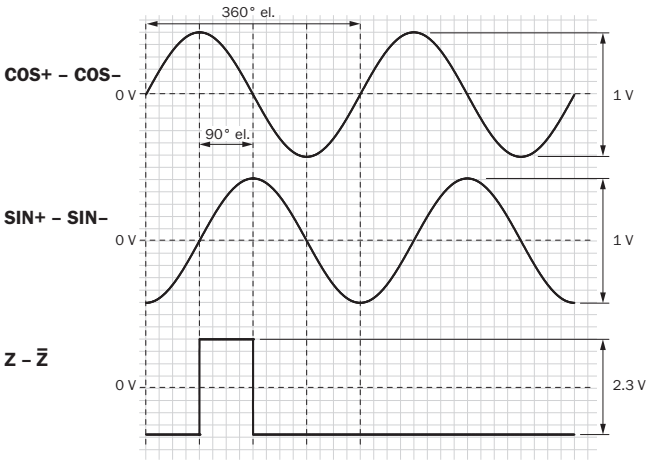
Signal SIN/COS before differential generation



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

Signal	Interface signals	Signal before differential generation At load 120 Ω	Signal offset
+ SIN - SIN + COS - COS	Analog, differential	0,5 V_{SS} ± 20 %	2,5 V ± 10 %
Z Z_	Digital differential	Low: 1,75 V ± 15 %, High: 2,90 V ± 15 %	

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}

Recommended accessories

Other models and accessories ➜ www.sick.com/DFS60S_Pro

	Brief description	Type	Part no.
Plug connectors and cables			
	Head A: cable Head B: Flying leads Cable: SSI, Incremental, HIPERFACE®, PUR, halogen-free, shielded	LTG-2308-MWENC	6027529
	Head A: cable Head B: Flying leads Cable: SSI, Incremental, PUR, shielded	LTG-2411-MW	6027530
	Head A: cable Head B: Flying leads Cable: SSI, Incremental, PUR, halogen-free, shielded	LTG-2512-MW	6027531
	Head A: cable Head B: Flying leads Cable: SSI, TTL, HTL, Incremental, PUR, halogen-free, shielded	LTG-2612-MW	6028516
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 2 m	DOL-2312-G02MLA3	2030682
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, halogen-free, shielded, 3 m	DOL-2312-G03MMA3	2029213
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, halogen-free, shielded, 5 m	DOL-2312-G05MMA3	2029214
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 7 m	DOL-2312-G07MLA3	2030685
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 10 m	DOL-2312-G10MLA3	2030688
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, halogen-free, shielded, 10 m	DOL-2312-G10MMA3	2029215
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 15 m	DOL-2312-G15MLA3	2030692
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, halogen-free, shielded, 1.5 m	DOL-2312-G1M5MA3	2029212
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 20 m	DOL-2312-G20MLA3	2030695
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, halogen-free, shielded, 20 m	DOL-2312-G20MMA3	2029216
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 25 m	DOL-2312-G25MLA3	2030699
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, shielded, 30 m	DOL-2312-G30MLA3	2030702
	Head A: female connector, M23, 12-pin, straight Head B: Flying leads Cable: Incremental, PUR, halogen-free, shielded, 30 m	DOL-2312-G30MMA3	2029217

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	Brief description	Type	Part no.
	Head A: male connector, M23, 12-pin, straight Cable: HIPERFACE®, SSI, Incremental, shielded	STE-2312-G01	2077273

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SICK is one of the leading manufacturers of intelligent sensors and sensor solutions for industrial applications. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

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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