



DFS60B-S1AA02000

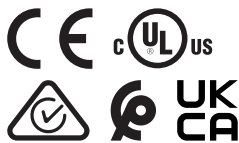
DFS60

INCREMENTAL ENCODERS

SICK
Sensor Intelligence.



Illustration may differ



Ordering information

Type	part no.
DFS60B-S1AA02000	1037198

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

Pulses per revolution	2,000 ¹⁾
Measuring step	90°, electric/pulses per revolution
Measuring step deviation at non binary number of lines	± 0.01°
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)

Electronics

Connection type	Male connector, M23, 12-pin, radial
Supply voltage	4.5 ... 5.5 V

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

Reference signal, number	1
Reference signal, position	90 °, electric, logically gated with A and B
Short-circuit protection of the outputs	✓ ¹⁾

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

Mechanics

Mechanical design	Solid shaft, Servo flange
Shaft diameter	6 mm With flat
Shaft length	10 mm
Weight	+ 0.3 kg
Shaft material	Stainless steel
Flange material	Aluminum
Housing material	Aluminum die cast
Start up torque	0.5 Ncm (+20 °C)
Operating torque	0.3 Ncm (+20 °C)
Permissible shaft loading	80 N (radial) 40 N (axial)
Operating speed	≤ 9,000 min ⁻¹ ¹⁾
Moment of inertia of the rotor	6.2 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⁾ IP65, shaft side (IEC 60529)
Permissible relative humidity	90 % (Condensation not permitted)
Operating temperature range	-40 °C ... +100 °C ²⁾ -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	✓

✓

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

Technical drawing of a 3D-printed part, showing three views: front, side, and top.

Front View Dimensions:

- Overall length: 58 ± 0.1 (2.28)
- Distance from left face to center of hole: $51.5 - 0.2$ (2.03)
- Hole diameter: $\varnothing 50$ (1.97) f8
- Distance from left face to hole center: $\varnothing 6$ (0.24) f7
- Distance from hole center to right face: 9.5 (0.37)
- Distance from left face to hole center: 10 ± 0.3 (0.39)
- Distance from left face to hole center: 5.7 (0.22)
- Distance from hole center to right face: 10 ± 0.1 (0.39)
- Distance from hole center to right face: 14.5 (0.57)
- Distance from hole center to right face: 7.75 (0.31)
- Overall diameter: $\varnothing 60$ (2.36)
- Distance from hole center to right face: 40.1 (1.58)
- Thread: M12 x 1
- Distance from hole center to right face: 40.1 (1.58)

Side View Dimensions:

- Overall length: 26.1 (1.03)
- Distance from left face to center of hole: 13 (0.51)
- Thread: M23 x 1

Top View Dimensions:

- Overall diameter: $\varnothing 42 \pm 0.05$ (1.65)
- Distance from center to hole center: $3 \times M4$ (6-deep)
- Distance from center to hole center: $3 \times 120^\circ$
- Distance from center to hole center: $25^\circ \pm 2^\circ$
- Distance from center to hole center: $\varnothing 0.1$ C

Surface Finish Symbols:

- Symbol 1: $\sqrt{0.03}$ A
- Symbol 2: $\sqrt{0.05}$ B
- Symbol 3: $\sqrt{0.1}$ A
- Symbol 4: $\sqrt{0.1}$ A
- Symbol 5: $\sqrt{0.1}$ A
- Symbol 6: $\sqrt{0.1}$ A
- Symbol 7: $\sqrt{0.1}$ A
- Symbol 8: $\sqrt{0.1}$ A
- Symbol 9: $\sqrt{0.1}$ A
- Symbol 10: $\sqrt{0.1}$ A
- Symbol 11: $\sqrt{0.1}$ A
- Symbol 12: $\sqrt{0.1}$ A
- Symbol 13: $\sqrt{0.1}$ A
- Symbol 14: $\sqrt{0.1}$ A
- Symbol 15: $\sqrt{0.1}$ A
- Symbol 16: $\sqrt{0.1}$ A
- Symbol 17: $\sqrt{0.1}$ A
- Symbol 18: $\sqrt{0.1}$ A
- Symbol 19: $\sqrt{0.1}$ A
- Symbol 20: $\sqrt{0.1}$ A
- Symbol 21: $\sqrt{0.1}$ A
- Symbol 22: $\sqrt{0.1}$ A
- Symbol 23: $\sqrt{0.1}$ A
- Symbol 24: $\sqrt{0.1}$ A
- Symbol 25: $\sqrt{0.1}$ A
- Symbol 26: $\sqrt{0.1}$ A
- Symbol 27: $\sqrt{0.1}$ A
- Symbol 28: $\sqrt{0.1}$ A
- Symbol 29: $\sqrt{0.1}$ A
- Symbol 30: $\sqrt{0.1}$ A
- Symbol 31: $\sqrt{0.1}$ A
- Symbol 32: $\sqrt{0.1}$ A
- Symbol 33: $\sqrt{0.1}$ A
- Symbol 34: $\sqrt{0.1}$ A
- Symbol 35: $\sqrt{0.1}$ A
- Symbol 36: $\sqrt{0.1}$ A
- Symbol 37: $\sqrt{0.1}$ A
- Symbol 38: $\sqrt{0.1}$ A
- Symbol 39: $\sqrt{0.1}$ A
- Symbol 40: $\sqrt{0.1}$ A
- Symbol 41: $\sqrt{0.1}$ A
- Symbol 42: $\sqrt{0.1}$ A
- Symbol 43: $\sqrt{0.1}$ A
- Symbol 44: $\sqrt{0.1}$ A
- Symbol 45: $\sqrt{0.1}$ A
- Symbol 46: $\sqrt{0.1}$ A
- Symbol 47: $\sqrt{0.1}$ A
- Symbol 48: $\sqrt{0.1}$ A
- Symbol 49: $\sqrt{0.1}$ A
- Symbol 50: $\sqrt{0.1}$ A
- Symbol 51: $\sqrt{0.1}$ A
- Symbol 52: $\sqrt{0.1}$ A
- Symbol 53: $\sqrt{0.1}$ A
- Symbol 54: $\sqrt{0.1}$ A
- Symbol 55: $\sqrt{0.1}$ A
- Symbol 56: $\sqrt{0.1}$ A
- Symbol 57: $\sqrt{0.1}$ A
- Symbol 58: $\sqrt{0.1}$ A
- Symbol 59: $\sqrt{0.1}$ A
- Symbol 60: $\sqrt{0.1}$ A
- Symbol 61: $\sqrt{0.1}$ A
- Symbol 62: $\sqrt{0.1}$ A
- Symbol 63: $\sqrt{0.1}$ A
- Symbol 64: $\sqrt{0.1}$ A
- Symbol 65: $\sqrt{0.1}$ A
- Symbol 66: $\sqrt{0.1}$ A
- Symbol 67: $\sqrt{0.1}$ A
- Symbol 68: $\sqrt{0.1}$ A
- Symbol 69: $\sqrt{0.1}$ A
- Symbol 70: $\sqrt{0.1}$ A
- Symbol 71: $\sqrt{0.1}$ A
- Symbol 72: $\sqrt{0.1}$ A
- Symbol 73: $\sqrt{0.1}$ A
- Symbol 74: $\sqrt{0.1}$ A
- Symbol 75: $\sqrt{0.1}$ A
- Symbol 76: $\sqrt{0.1}$ A
- Symbol 77: $\sqrt{0.1}$ A
- Symbol 78: $\sqrt{0.1}$ A
- Symbol 79: $\sqrt{0.1}$ A
- Symbol 80: $\sqrt{0.1}$ A
- Symbol 81: $\sqrt{0.1}$ A
- Symbol 82: $\sqrt{0.1}$ A
- Symbol 83: $\sqrt{0.1}$ A
- Symbol 84: $\sqrt{0.1}$ A
- Symbol 85: $\sqrt{0.1}$ A
- Symbol 86: $\sqrt{0.1}$ A
- Symbol 87: $\sqrt{0.1}$ A
- Symbol 88: $\sqrt{0.1}$ A
- Symbol 89: $\sqrt{0.1}$ A
- Symbol 90: $\sqrt{0.1}$ A
- Symbol 91: $\sqrt{0.1}$ A
- Symbol 92: $\sqrt{0.1}$ A
- Symbol 93: $\sqrt{0.1}$ A
- Symbol 94: $\sqrt{0.1}$ A
- Symbol 95: $\sqrt{0.1}$ A
- Symbol 96: $\sqrt{0.1}$ A
- Symbol 97: $\sqrt{0.1}$ A
- Symbol 98: $\sqrt{0.1}$ A
- Symbol 99: $\sqrt{0.1}$ A
- Symbol 100: $\sqrt{0.1}$ A

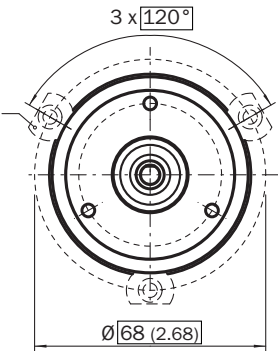
4 INCREMENTAL ENCODERS | SICK

Mounting requirements for half-shell servo clamp



All dimensions in mm (inch)
part no. 2029165

Mounting requirements for small servo clamp



All dimensions in mm (inch)
part no. 2029166

PIN assignment



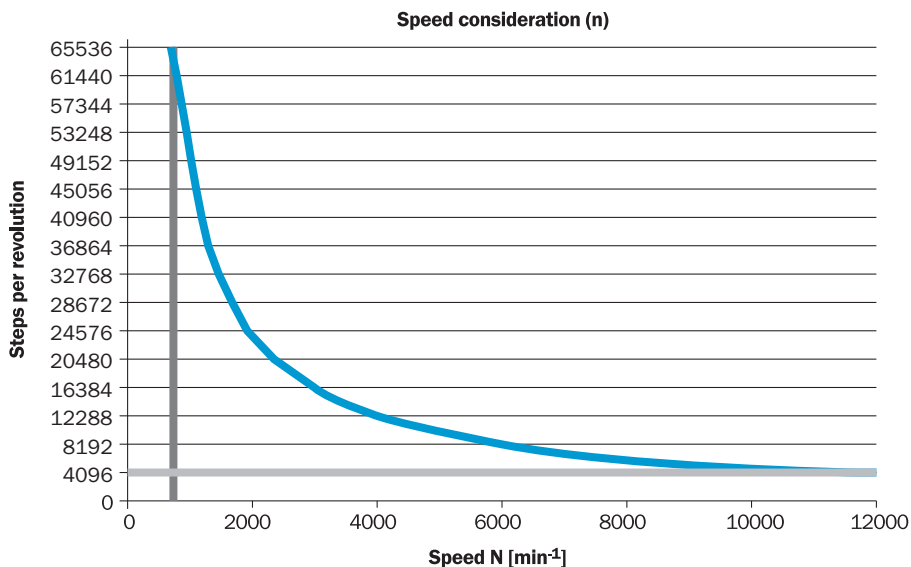
view of M23 male device connector on encoder

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

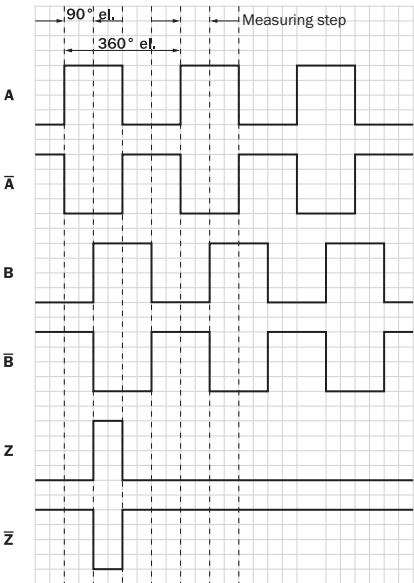
PINMale connector M12, 8-pin	PINMale connector M23, 12-pin	Wire colors (cable connection)	TTL/HTL signal	Sin/Cos 1.0 V _{pp}	Explanation
6	3	Purple	Z	Z	Signal wire
7	10	Blue	GND	GND	Ground connection
8	12	Red	+U _S	+U _S	Supply voltage
-	9	-	N.c.	N.c.	Not assigned
-	2	-	N.c.	N.c.	Not assigned
-	11	-	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 U_S 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".

maximum revolution range



signal outputs



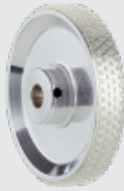
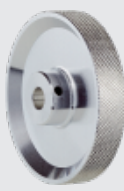
CW with view on the encoder shaft in direction “A”, compare dimensional drawing.

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

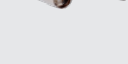
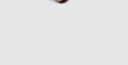
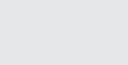
Recommended accessories

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

	Brief description	Type	part no.
shaft adaptation			
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular $\pm 4^\circ$; max. speed 10,000 rpm, -30°C to $+120^\circ\text{C}$, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub	KUP-0610-B	5312982
	Product segment: Shaft adaptation Product: Shaft couplings Description: Double loop coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radially ± 2.5 mm, axially ± 3 mm, angle ± 10 degrees; max. speed 3,000 rpm, -30 to $+80$ degrees Celsius, torsional spring stiffness of 25 Nm/rad	KUP-0610-D	5326697
	Product segment: Shaft adaptation Product: Shaft couplings Description: Spring washer coupling, shaft diameter 6 mm / 10 mm, Maximum shaft offset: radial ± 0.3 mm, axial ± 0.4 mm, angular $\pm 2.5^\circ$; max. speed 12,000 rpm, -10° to $+80^\circ\text{C}$, max. torque 60 Ncm; material: aluminum flange, glass fiber-reinforced polyamide membrane and hardened steel coupling pin	KUP-0610-F	5312985
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bar coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radial ± 0.3 mm, axial ± 0.3 mm, angular $\pm 3^\circ$; max. speed 10,000 rpm, -10° to $+80^\circ\text{C}$, max. torque: 80 Ncm, material: fiber-glass reinforced polyamide, aluminum hub	KUP-0610-S	2056407
	Product segment: Shaft adaptation Product: Shaft couplings Description: Claw coupling, shaft diameter 6 mm / 10 mm, damping element 80 shore blue, maximum shaft offset: radial ± 0.22 mm, axial ± 1 mm angular $\pm 1.3^\circ$, max. speed 19,000 rpm, angle of twist max. 10°, -30°C to $+80^\circ\text{C}$, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane	KUP-0610-J	2127056
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bar coupling, shaft diameter 6 mm / 8 mm, maximum shaft offset radial ± 0.3 mm, axial ± 0.2 mm, angle $\pm 3^\circ$, max. speed 10,000 rpm, torsion spring rigidity 38 Nm/wheel; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0608-S	5314179
	Product segment: Shaft adaptation Product: Shaft couplings Description: Cross-slotted coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angle $\pm 3^\circ$; max. speed 10,000 rpm, -10° to $+80^\circ\text{C}$, max. torque 80 Ncm; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0606-S	2056406
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bellows coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular $\pm 4^\circ$; max. speed 10,000 rpm, -30°C to $+120^\circ\text{C}$, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub	KUP-0606-B	5312981

	Brief description	Type	part no.
measuring wheels and measuring wheel mechanics			
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with studded polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200APN	4084747
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminium measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 200 mm	BEF-MR006020R	2055222
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 300 mm	BEF-MR006030R	2055634
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminium measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 500 mm	BEF-MR006050R	2055225
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with cross-knurled surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200AK	4084745
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with smooth polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200AP	4084746
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with ridged polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200APG	4084748

	Brief description	Type	part no.
Mounting systems			
	Description: Bearing block for servo and face mount flange encoder. The heavy-duty bearing block is used to absorb very large radial and axial shaft loads. Particularly when using belt pulleys, chain sprockets, friction wheels. Operating speed max. 4,000 rpm⁻¹, axial shaft load 150 N, radial shaft load 250 N, bearing service life 3.6 x 10⁹ revolutions	BEF-FA-LB1210	2044591
	Description: Mounting kit for servo flange encoder on the bearing block, 1 bar coupling SKPS 1520 06/06 1 hexagon socket wrench SW1.5 DIN 911, 3 mounting eccentric BEMN 1242 49 3 screws M4 x 10 DIN 912, 1 hexagon socket wrench SW3 DIN 911 Items supplied: 1 bar coupling SKPS 1520 06/06 1 hexagon socket wrench SW1.5 DIN 911, 3 mounting eccentric BEMN 1242 49 3 screws M4 x 10 DIN 912, 1 hexagon socket wrench SW3 DIN 911	BEF-MK-LB	5320872
	Description: Servo clamps, large, for servo flange (clamps, eccentric fastener), 3 pcs, without mounting material Items supplied: Without mounting hardware	BEF-WK-SF	2029166
	Description: Mounting bell for encoder with servo flange, 50 mm spigot Items supplied: Mounting kit included	BEF-MG-50	5312987

	Brief description	Type	part no.
connectors and cables			
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 2 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G02MLA3	2030682
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 7 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G07MLA3	2030685
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 10 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G10MLA3	2030688
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 15 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G15MLA3	2030692
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 20 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G20MLA3	2030695
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 25 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G25MLA3	2030699
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 30 m, 11-wire, PUR • Description: Incremental, shielded	DOL-2312-G30MLA3	2030702
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 1.5 m, 12-wire, PUR, halogen-free • Description: Incremental, shielded	DOL-2312-G1M5MA3	2029212
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 3 m, 12-wire, PUR, halogen-free • Description: Incremental, shielded	DOL-2312-G03MMA3	2029213
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 5 m, 12-wire, PUR, halogen-free • Description: Incremental, shielded	DOL-2312-G05MMA3	2029214
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 10 m, 12-wire, PUR, halogen-free • Description: Incremental, shielded	DOL-2312-G10MMA3	2029215
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 20 m, 12-wire, PUR, halogen-free • Description: Incremental, shielded	DOL-2312-G20MMA3	2029216
	• Connection type head A: Female connector, M23, 12-pin, straight • Connection type head B: Flying leads • Signal type: Incremental • Cable: 30 m, 12-wire, PUR, halogen-free	DOL-2312-G30MMA3	2029217

	Brief description	Type	part no.
	• Description: Incremental, shielded • Connection type head A: Female connector, M23, 12-pin, straight, A-coded • Signal type: HIPERFACE[®], SSI, Incremental • Description: HIPERFACE[®], shieldedSSIIncremental • Connection systems: Solder connection	DOS-2312-G02	2077057
	• Connection type head A: Female connector, M23, 12-pin, angled, A-coded • Signal type: HIPERFACE[®], SSI, Incremental • Description: HIPERFACE[®], shieldedSSIIncremental • Connection systems: Solder connection	DOS-2312-W01	2072580

SICK AT A GLANCE

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.

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

For us, that is “Sensor Intelligence.”

WORLDWIDE PRESENCE:

Contacts and other locations –www.sick.com