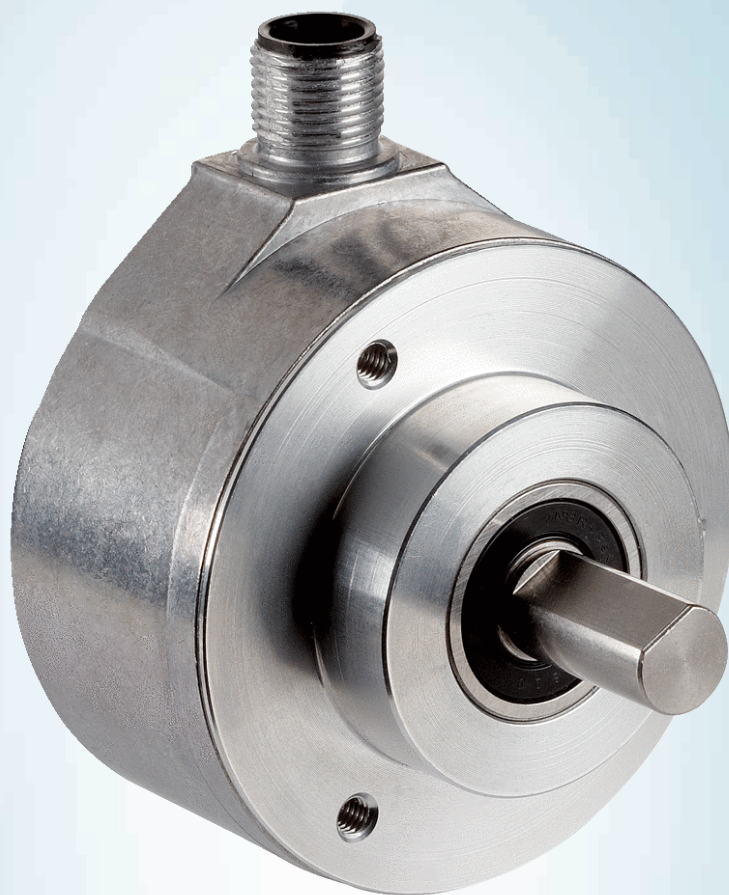




DFS60E-S4EC02000

DFS60

INCREMENTAL ENCODERS

SICK
Sensor Intelligence.

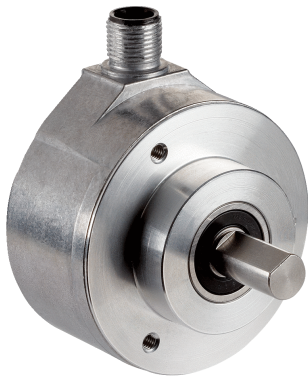
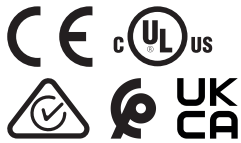


Illustration may differ



Ordering information

Type	part no.
DFS60E-S4EC02000	1037478

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⁾
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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	± 0.2°
Error limits	± 0.3°

¹⁾ See maximum revolution range.

Interfaces

Communication interface	Incremental
Communication Interface detail	HTL / Push pull
Number of signal channels	6-channel
Initialization time	40 ms
Output frequency	≤ 300 kHz
Load current	≤ 30 mA
Power consumption	≤ 0.5 W (without load)

Electronics

Connection type	Male connector, M12, 8-pin, radial
Supply voltage	10 ... 32 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
Reverse polarity protection	✓
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, face mount flange
Shaft diameter	10 mm With flat
Shaft length	19 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 61000-6-4
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	0 °C ... +85 °C
Storage temperature range	-40 °C ... +100 °C, without package
Resistance to shocks	50 g, 6 ms (EN 60068-2-27)
Resistance to vibration	20 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)

¹⁾ With mating connector fitted.

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

A

Technical drawing of a mechanical part showing three views: front, side, and top.

Front View:

- Total length: 40.1 (1.58)
- Distance from left face to centerline: 10 (0.39)
- Left diameter: Ø 36 (1.42)
- Left surface texture: 0.03 A
- Top surface texture: 0.005 B
- Internal step diameter: Ø 10 (0.39) f7
- Step height: 18 (0.71)
- Bottom flange outer diameter: Ø 60 (2.36)
- Bottom flange thickness: 7.75 (0.31)
- Bottom flange bore: M12 x 1
- Bottom flange mounting hole: M23 x 1
- Bottom flange distance from centerline: 14.5 (0.57)
- Right surface texture: 0.1 A
- Internal step diameter: 19 ± 0.3 (0.75)
- Step width: 9 (0.35)
- Feature C: Hole at the end of the main body.

Side View:

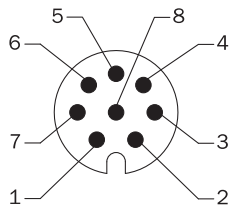
- Profile view showing the transition between diameters.
- Dimension 26.1 (1.03) indicates the radius of the fillet.

Top View:

- Circular face with three holes arranged in a triangle.
- Hole diameter: Ø 13 (0.51)
- Triangle angle: 25° ± 2°
- Outer diameter: Ø 48 ± 0.05 (1.89)
- Threaded hole: 3 x M4 (6-deep)
- Surface texture: 0.1 C

4 INCREMENTAL ENCODERS | SICK

PIN assignment



view of M12 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	$\bar{A}$	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 _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	O-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 O-SET function on PIN 7 on M23 plug. The O-SET input is used to set the zero pulse to the current shaft position. If the O-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".

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

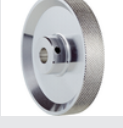
Recommended accessories

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: Double loop coupling, shaft diameter 8 mm / 10 mm, max. shaft offset: radially ± 0.25 mm, axially ± 0.4 mm, angle ± 4 degrees; max. speed 10,000 rpm, -30 to $+120$ degrees Celsius, torsional spring stiffness of 150 Nm/rad	KUP-0810-D	5326704
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bar coupling, shaft diameter 8 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-0810-S	5314178
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bellows coupling, shaft diameter 10 mm/10 mm; maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular $\pm 4^\circ$; max. revolutions 10,000 rpm, -30° to $+120^\circ\text{C}$, max. torque 120 Ncm; material: stainless steel bellows, aluminum clamping hubs	KUP-1010-B	5312983
	Product segment: Shaft adaptation Product: Shaft couplings Description: Double loop coupling, shaft diameter 10 mm / 10 mm, Maximum shaft offset: radial ± 2.5 mm, axial ± 3 mm, angular $\pm 10^\circ$; max. speed 3,000 rpm, -30° to $+80^\circ\text{C}$, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange	KUP-1010-D	5326703
	Product segment: Shaft adaptation Product: Shaft couplings Description: Spring washer coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle $\pm 2.5^\circ$, torsion spring stiffness 30 Nm/rad; material: aluminum flange, glass-fiber reinforced polyamide membrane and hardened steel coupling pin	KUP-1010-F	5312986
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bar coupling, shaft diameter 10 mm / 10 mm; maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angular $\pm 3^\circ$; speed 10,000 rpm, -10° to $+80^\circ\text{C}$, max. torque 80 Ncm; material: glass fiber-reinforced polyamide, aluminum hub	KUP-1010-S	2056408
	Product segment: Shaft adaptation Product: Shaft couplings	KUP-1012-B	5312984

	Brief description	Type	part no.
	Description: 10 mm / 12 mm; maximum shaft offset: radial +/- 0.25 mm, axial +/- 0.4 mm, angular +/- 4°; max. revolutions 10,000 rpm, -30° to +120 °C, max. torque 120 Ncm; material: stainless steel bellows, aluminum clamping hubs		
	Product segment: Shaft adaptation Product: Shaft couplings Description: Double loop coupling, shaft diameter 10 mm / 12 mm, Maximum shaft offset: radial +/- 2.5 mm, axial +/- 3 mm, angular +/- 10°; max. speed 3,000 rpm, -30° to +80 °C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange	KUP-1012-D	5326702
	Product segment: Shaft adaptation Product: Shaft couplings Description: Claw coupling, shaft diameter 8 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 °C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane	KUP-0810-J	2128267
	Product segment: Shaft adaptation Product: Shaft couplings Description: Claw coupling, shaft diameter 10 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 °C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane	KUP-1010-J	2127054
	Product segment: Shaft adaptation Product: Shaft couplings Description: Claw coupling, shaft diameter 10 mm / 12 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 °C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane	KUP-1012-J	2128265

	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 wheel mechanics • Description: SICK modular measuring wheel system for face mount flange encoder with S4 mechanical design (10 mm x 19 mm solid shaft), e.g., DFS60-S4: with O-ring measuring wheel, circumference 200 mm	BEF-MRS-10-U	2085714

	Brief description	Type	part no.
	Suitable for: Face mount flange encoder DFS60, DBS60, AFM60, AFS60, mechanical design S4 (solid shaft 10 mm x 19 mm)		
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminium measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 200 mm	BEF-MR010020R	2055224
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminium measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 300 mm	BEF-MR010030R	2049278
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 500 mm	BEF-MR010050R	2055227
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with cross-knurled surface for 10 mm solid shaft, circumference 200 mm	BEF-MR10200AK	4084737
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with smooth polyurethane surface for 10 mm solid shaft, circumference 200 mm	BEF-MR10200AP	4084738
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with studded polyurethane surface for 10 mm solid shaft, circumference 200 mm	BEF-MR10200APN	4084739
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with cross-knurled surface for 10 mm solid shaft, circumference 500 mm	BEF-MR10500AK	4084733
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with smooth polyurethane surface for 10 mm solid shaft, circumference 500 mm	BEF-MR10500AP	4084734
	Product segment: Measuring wheels and measuring wheel mechanics Product: Measuring wheels Description: Aluminum measuring wheel with ridged polyurethane surface for 10 mm solid shaft, circumference 500 mm	BEF-MR10500APG	4084736

	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 bracket for encoder with spigot 36 mm for face mount flange Items supplied: Mounting kit included	BEF-WF-36	2029164
	Description: Flange adapter, adaptation of face mount flange with 36 mm centering hub to 50 mm servo flange, aluminum, including 3 flat head screws M4 x 10 Material: Aluminum Details: Aluminum Items supplied: Including 3 countersunk screws M3 x 10	BEF-FA-036-050	2029160
	Description: Flange adapter, adaptation of face mount flange with 36 mm centering hub to 60 mm square mounting plate, aluminum, including 3 flat head screws M4 x 8 Material: Aluminum Details: Aluminum Items supplied: Including 3 countersunk screws M4 x 8	BEF-FA-036-060REC	2029162
	Description: Flange adapter, adaptation of face mount flange with 36 mm centering hub to 58 mm square mounting plate with shock absorbers, aluminum Material: Aluminum Details: Aluminum	BEF-FA-036-060RSA	2029163
	Description: Flange adapter, adaptation of face mount flange with 36 mm centering hub to 63 mm square mounting plate, aluminum, including 3 flat head screws M4 x 8 Material: Aluminum Details: Aluminum Items supplied: Including 3 countersunk screws M4 x 8	BEF-FA-036-063REC	2034225
	Description: Flange adapter, adaptation of face mount flange with 36 mm centering hub to 100 mm servo flange with 60 mm centering hub, aluminum Material: Aluminum Details: Aluminum	BEF-FA-036-100	2029161
	Description: Flange adapter (adapts size 60 face mount flange encoder to bearing block with part. no. 2044591)	BEF-FA-036-050-019	2063378
	Description: Mounting angle spring-loaded, for flange with centerring collar 36 mm, working temperature range -40° ... +120°C Material: Aluminum Details: Aluminum	BEF-WF36F	4084775

	Brief description	Type	part no.
connectors and cables			
	Connection type head A: Female connector, M12, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Cable: 2 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI Connection systems: Flying leads Application: Drag chain operation, Zones with oils and lubricants	DOL-1208-G02MAC1	6032866
	Connection type head A: Female connector, M12, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Cable: 5 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI Connection systems: Flying leads Application: Drag chain operation, Zones with oils and lubricants	DOL-1208-G05MAC1	6032867
	Connection type head A: Female connector, M12, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Cable: 10 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI Connection systems: Flying leads Application: Drag chain operation, Zones with oils and lubricants	DOL-1208-G10MAC1	6032868
	Connection type head A: Female connector, M12, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Cable: 20 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI Connection systems: Flying leads Application: Drag chain operation, Zones with oils and lubricants	DOL-1208-G20MAC1	6032869
	Description: Incremental, shielded, SSI Connection type head A: Female connector, M12, 8-pin, straight, A-coded Signal type: Incremental, SSI Cable: CAT5, CAT5e Connection systems: IDC quick connection Permitted cross-section: 0.14 mm² ... 0.34 mm²	DOS-1208-GA01	6045001
	Connection type head A: Female connector, M12, 8-pin, angled Connection type head B: Flying leads Signal type: HIPERFACE[®], Incremental Cable: 2 m, 8-wire, PUR, halogen-free Description: HIPERFACE[®], shielded, Incremental Application: Zones with oils and lubricants	DOL-1208-W02MAC1	6037724
	Connection type head A: Female connector, M12, 8-pin, angled Connection type head B: Flying leads Signal type: HIPERFACE[®], Incremental Cable: 5 m, 8-wire, PUR, halogen-free Description: HIPERFACE[®], shielded, Incremental Application: Zones with oils and lubricants	DOL-1208-W05MAC1	6037725
	Connection type head A: Female connector, M12, 8-pin, angled Connection type head B: Flying leads Signal type: HIPERFACE[®], Incremental Cable: 10 m, 8-wire, PUR, halogen-free Description: HIPERFACE[®], shielded, Incremental Application: Zones with oils and lubricants	DOL-1208-W10MAC1	6037726
	Connection type head A: Female connector, M12, 8-pin, angled Connection type head B: Flying leads Signal type: HIPERFACE[®], Incremental Cable: 20 m, 8-wire, PUR Description: HIPERFACE[®], shielded, Incremental Application: Zones with oils and lubricants	DOL-1208-W20MAC1	6037727
	Connection type head A: Female connector, M12, 8-pin, angled Connection type head B: Flying leads Cable: 2 m, 8-wire, PVC Description: Shielded	DOL-1208-W02MA	6020992

	Brief description	Type	part no.
	• Connection systems: Flying leads • Connection type head A: Female connector, M12, 8-pin, angled • Connection type head B: Flying leads • Signal type: Sensor/actuator cable • Cable: 2 m, 8-wire, PUR, halogen-free • Description: Sensor/actuator cable, shielded • Connection systems: Flying leads	DOL-1208-W02MAS01	6029224
	• Connection type head A: Female connector, M12, 8-pin, angled • Connection type head B: Flying leads • Cable: 2 m, 8-wire, PUR, halogen-free • Description: Unshielded	DOL-1208-W02MC	6035623
	• Connection type head A: Female connector, M12, 8-pin, angled • Connection type head B: Flying leads • Cable: 5 m, 8-wire, PVC • Description: Shielded • Connection systems: Flying leads	DOL-1208-W05MA	6021033
	• Connection type head A: Female connector, M12, 8-pin, angled • Connection type head B: Flying leads • Cable: 5 m, 8-wire, PUR • Description: Unshielded	DOL-1208-W05MC	6035624
	• Connection type head A: Female connector, M12, 8-pin, angled • Connection type head B: Flying leads • Cable: 10 m, 8-wire, PUR, halogen-free • Description: Unshielded	DOL-1208-W10MC	6035625

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.

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For us, that is “Sensor Intelligence.”

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