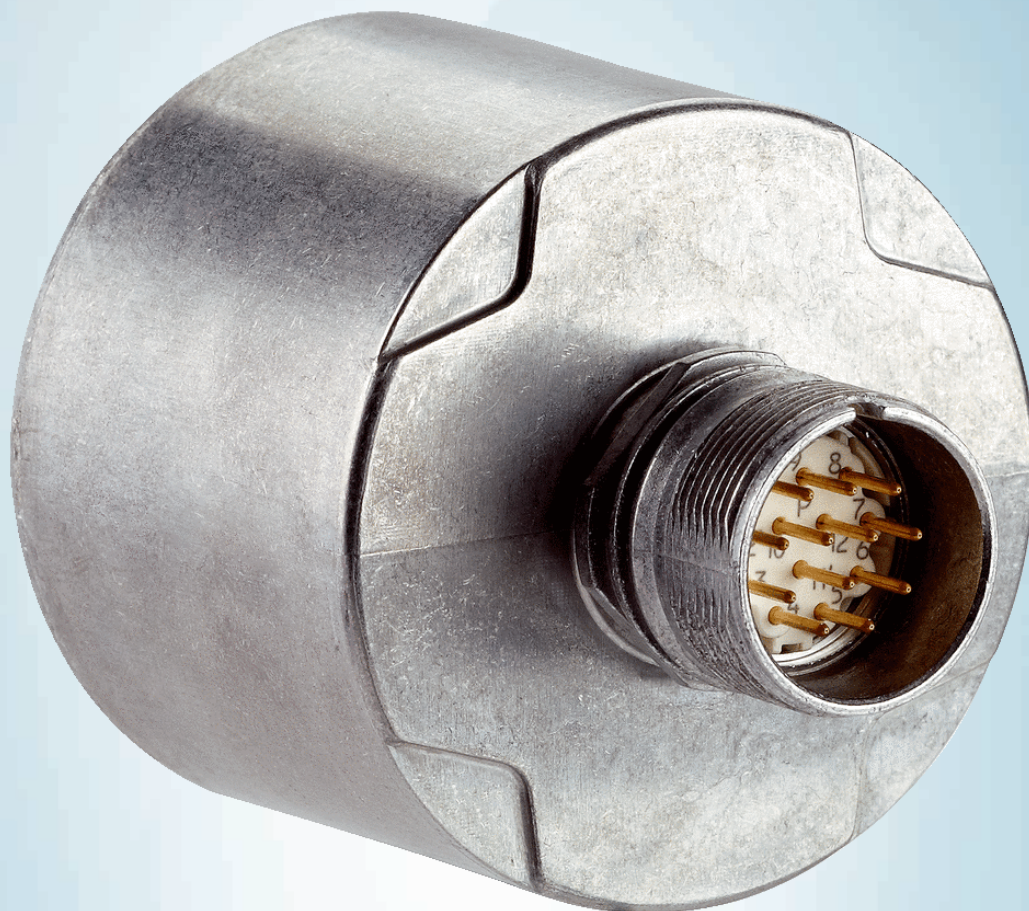




DFS60B-S1CB04096

DFS60

INCREMENTAL ENCODERS

SICK
Sensor Intelligence.



Illustration may differ



Ordering information

Type	Part no.
DFS60B-S1CB04096	1084399

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	4,096 ¹⁾
Measuring step	90°, electric/pulses per revolution
Measuring step deviation at binary number of lines	± 0.008°
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
Power consumption	≤ 0.5 W (without load)

Electronics

Connection type	Male connector, M23, 12-pin, axial
Supply voltage	10 ... 32 V
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 or GND permissible for maximum 30 s.

Mechanics

Mechanical design	Solid shaft, Servo flange
Shaft diameter	6 mm With face
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	$\leq 9,000 \text{ min}^{-1} \text{ } ^1$
Moment of inertia of the rotor	6.2 gcm ²
Bearing lifetime	3.6 x 10 ¹⁰ revolutions
Angular acceleration	$\leq 500,000 \text{ rad/s}^2$

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	-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.

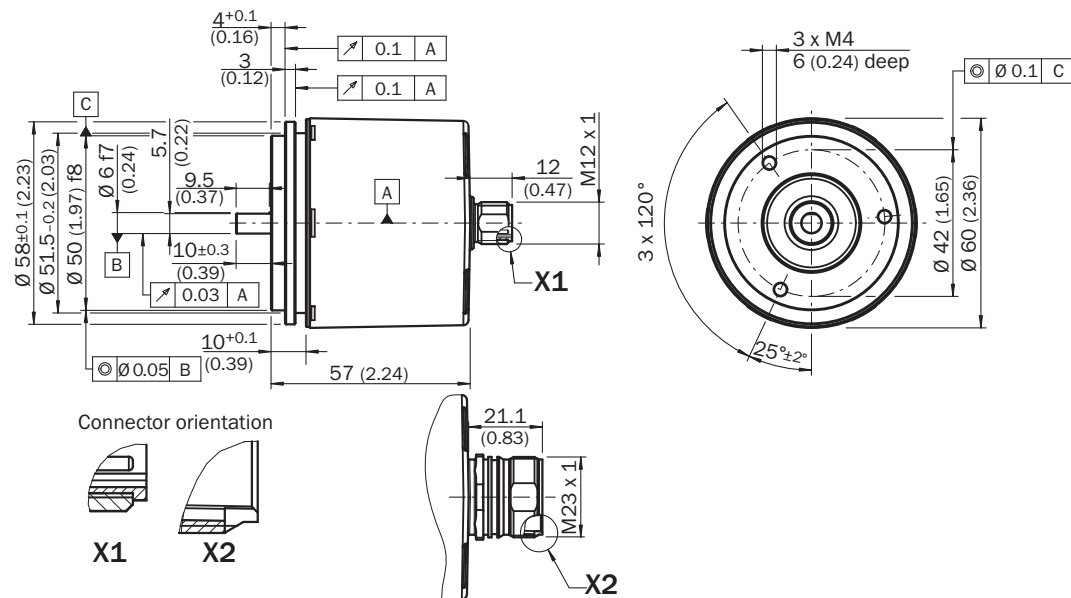
Classifications

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 (Dimensions in mm (inch))

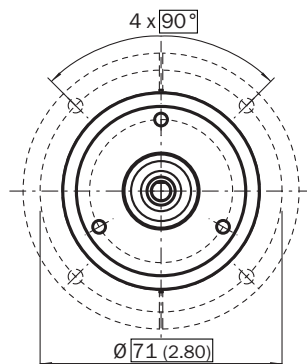
Servo flange, M12 and M23 axial male connector



General tolerances according to DIN ISO 2768-mk

Attachment specifications

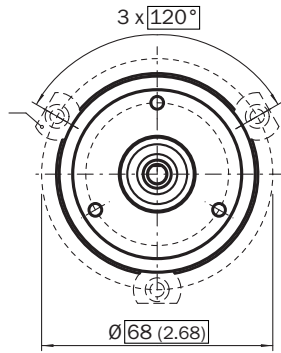
Mounting requirements for half-shell servo clamp



All dimensions in mm (inch)

Part no. 2029165

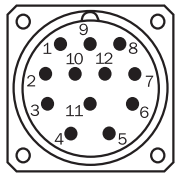
Mounting requirements for small servo clamp



All dimensions in mm (inch)

Part no. 2029166

PIN assignment



View of M23 male device connector on encoder

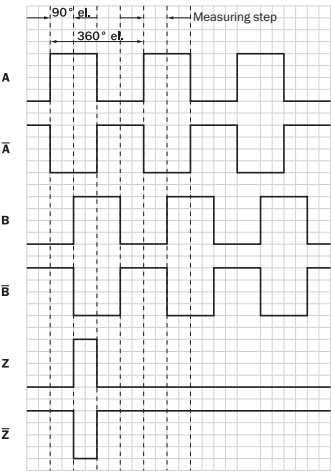
PIN Male connector M12, 8-pin	PIN Male connector M23, 12-pin	Wire colors (cable connection)	TTL/HTL signal	Sin/Cos 1.0 V _{pp}	Explanation
1	6	Brown	$\overline{A}$	COS-	Signal wire
2	5	White	A	COS+	Signal wire
3	1	Black	$\overline{B}$	SIN-	Signal wire
4	8	Pink	B	SIN+	Signal wire
5	4	Yellow	$\overline{Z}$	$\overline{Z}$	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	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)

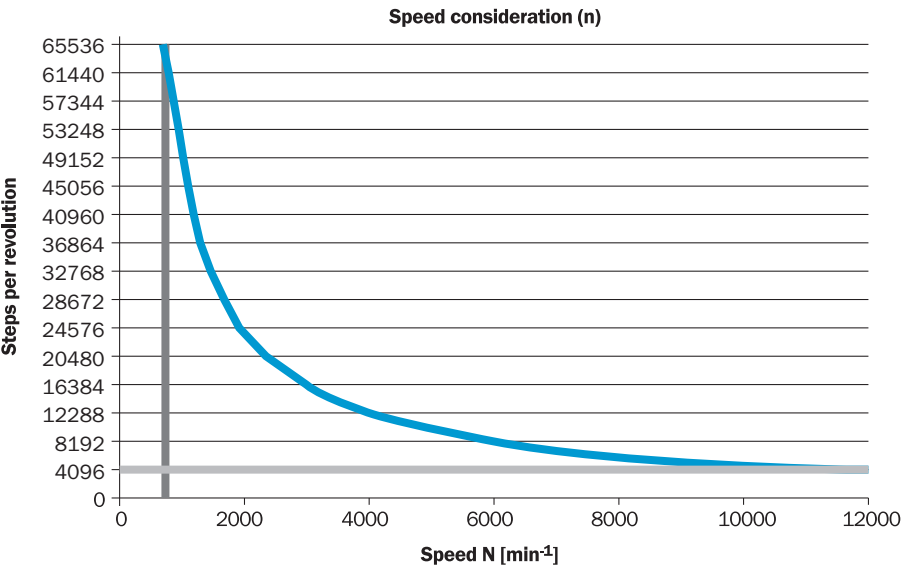
For electrical interfaces only: M, U, V, W with O-SET function on PIN 7 on M23 plug. The O-SET input is used to set the zero pulse to the current shaft position. If the O-SET input is applied to US for longer than 250 ms after it has previously been open or applied to GND for at least 1,000 ms, the current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

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

	Brief description	Type	Part no.
Other mounting accessories			
	Description: Aluminium measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 200 mm	BEF-MR006020R	2055222
	Description: Measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 300 mm	BEF-MR006030R	2055634
	Description: Aluminium measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 500 mm	BEF-MR006050R	2055225
	Description: Aluminum measuring wheel with cross-knurled surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200AK	4084745
	Description: Aluminum measuring wheel with smooth polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200AP	4084746
	Description: Aluminum measuring wheel with ridged polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200APG	4084748
	Description: Aluminum measuring wheel with studded polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200APN	4084747
	Description: Mounting bell for encoder with servo flange, 50 mm spigot Items supplied: Mounting kit included	BEF-MG-50	5312987
	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 3.6×10^9 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
Shaft adaptation			
	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
	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
	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
	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

	Brief description	Type	Part no.
	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
	Description: Spring washer coupling, shaft diameter 6 mm / 10 mm, Maximum shaft offset: radial +/- 0.3 mm, axial +/- 0.4 mm, angular +/- 2.5°; max. speed 12,000 rpm, -10° to +80 °C, max. torque 60 Ncm; material: aluminum flange, glass fiber-reinforced polyamide membrane and hardened steel coupling pin	KUP-0610-F	5312985
	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 °C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane	KUP-0610-J	2127056
	Description: Bar coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radial $\pm 0,3$ mm, axial $\pm 0,3$ mm, angular $\pm 3^\circ$; max. speed 10.000 rpm, -10° to +80 °C, max. torque: 80 Ncm, material: fiber-glass reinforced polyamide, aluminum hub	KUP-0610-S	2056407
Others			
	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, $4 \times 2 \times 0.25 \text{ mm}^2 + 2 \times 0.5 \text{ mm}^2 + 1 \times 0.14 \text{ mm}^2$, $\varnothing 7.8 \text{ mm}$	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, $4 \times 2 \times 0.25 \text{ mm}^2 + 2 \times 0.5 \text{ mm}^2 + 1 \times 0.14 \text{ mm}^2$, $\varnothing 7.8 \text{ mm}$	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, $4 \times 2 \times 0.25 \text{ mm}^2 + 2 \times 0.5 \text{ mm}^2 + 1 \times 0.14 \text{ mm}^2$, $\varnothing 7.8 \text{ mm}$	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, $4 \times 2 \times 0.25 \text{ mm}^2 + 2 \times 0.5 \text{ mm}^2 + 1 \times 0.14 \text{ mm}^2$, $\varnothing 7.8 \text{ mm}$	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, $4 \times 2 \times 0.25 \text{ mm}^2 + 2 \times 0.5 \text{ mm}^2 + 1 \times 0.14 \text{ mm}^2$, $\varnothing 7.8 \text{ mm}$	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, $4 \times 2 \times 0.25 \text{ mm}^2 + 2 \times 0.5 \text{ mm}^2 + 1 \times 0.14 \text{ mm}^2$, $\varnothing 7.8 \text{ mm}$	DOL-2312-G25MLA3	2030699

	Brief description	Type	Part no.
	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, Head A: female connector, M23, 12-pin, straight Head B: cable Cable: incremental, PUR, shielded, 4 x 2 x 0.25 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	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, 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 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	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, 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 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	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, 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 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	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, 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 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	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, 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 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	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 Description: 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 mm² + 2 x 0.5 mm² + 1 x 0.14 mm², Ø 7.8 mm	DOL-2312-G30MMA3	2029217
	Connection type head A: Female connector, M23, 12-pin, straight, A-coded Signal type: HIPERFACE[®], SSI, Incremental Description: HIPERFACE[®], 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 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[®], 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 Connection systems: Solder connection	DOS-2312-W01	2072580

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