

# DFS60I-Q4MC65536

DFS60

INCREMENTAL ENCODERS

**SICK**  
Sensor Intelligence.

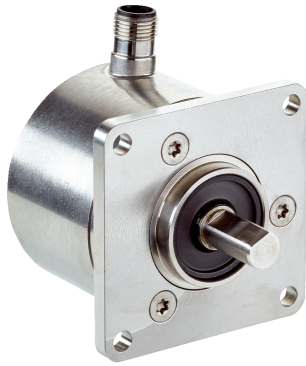


Illustration may differ



### Ordering information

| Type             | Part no. |
|------------------|----------|
| DFS60I-Q4MC65536 | 1083945  |

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

### Detailed technical data

#### Performance

|   |                                     |
|---|-------------------------------------|
| <b>Pulses per revolution</b>                              | 65,536 <sup>1)</sup>                |
| <b>Measuring step</b>                                     | 90°, electric/pulses per revolution |
| <b>Measuring step deviation at binary number of lines</b> | ± 0.0015°                           |
| <b>Error limits</b>                                       | ± 0.03°                             |

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

#### Interfaces

|  |   |
|--|---|
| <b>Communication interface</b>         | Incremental   |
| <b>Communication Interface detail</b>  | TTL / HTL   |
| <b>Factory setting</b>                 | Factory setting: output level TTL                               |
| <b>Number of signal channels</b>       | 6-channel   |
| <b>0-set function via hardware pin</b> | ✓   |
| <b>0-SET function</b>                  | H-active, L ≙ 0 - 3 V, H ≙ 4.0 - U <sub>s</sub> V <sup>1)</sup> |
| <b>Programmable/configurable</b>       | ✓   |
| <b>Initialization time</b>             | 32 ms <sup>2)</sup><br>30 ms                                    |
| <b>Output frequency</b>                | ≤ 820 kHz   |
| <b>Load current</b>                    | ≤ 30 mA   |
| <b>Operating current</b>               | 40 mA (without load)  |
| <b>Power consumption</b>               | ≤ 0.7 W (without load)  |
| <b>Load resistance</b>                 | ≥ 120 Ω   |

<sup>1)</sup> Only with devices with M12 connector in connection with electrical interfaces M, V and W.

<sup>2)</sup> With mechanical zero pulse width.

## Electrical data

|  |   |
|--|---|
| <b>Connection type</b>                         | Male connector, M12, 12-pin, radial         |
| <b>Supply voltage</b>                          | 4.5 ... 32 V                                |
| <b>Reference signal, number</b>                | 1   |
| <b>Reference signal, position</b>              | 90°, electric, logically gated with A and B |
| <b>Reverse polarity protection</b>             | ✓   |
| <b>Short-circuit protection of the outputs</b> | ✓ <sup>1) 2)</sup>                          |
| <b>MTTFd: mean time to dangerous failure</b>   | 300 years (EN ISO 13849-1) <sup>3)</sup>    |

<sup>1)</sup> Programming TTL with  $\geq 5.5$  V: short-circuit opposite to another channel or GND permissible for maximum 30 s.

<sup>2)</sup> Programming HTL or TTL with  $< 5.5$  V: short-circuit opposite to another channel, US or GND permissible for maximum 30 s.

<sup>3)</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.

## Mechanical data

|                                       |   |
|---------------------------------------|---|
| <b>Mechanical design</b>              | Solid shaft, Square flange                  |
| <b>Shaft diameter</b>                 | 10 mm                                       |
| <b>Shaft length</b>                   | 19 mm                                       |
| <b>Weight</b>                         | + 0.5 kg                                    |
| <b>Shaft material</b>                 | Stainless steel V2A                         |
| <b>Flange material</b>                | Stainless steel V2A                         |
| <b>Housing material</b>               | Stainless steel V2A                         |
| <b>Start up torque</b>                | 1 Ncm (+20 °C)                              |
| <b>Operating torque</b>               | 0.5 Ncm (+20 °C)                            |
| <b>Permissible shaft loading</b>      | 80 N (radial)<br>40 N (axial)               |
| <b>Operating speed</b>                | $\leq 9,000 \text{ min}^{-1}$ <sup>1)</sup> |
| <b>Moment of inertia of the rotor</b> | 6.2 gcm <sup>2</sup>                        |
| <b>Bearing lifetime</b>               | $3.6 \times 10^{10}$ revolutions            |
| <b>Angular acceleration</b>           | $\leq 500,000 \text{ rad/s}^2$              |

<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 (IEC 60529) <sup>1)</sup><br>IP67, shaft side (IEC 60529) |
| <b>Permissible relative humidity</b> | 90 % (Condensation not permitted)  |
| <b>Operating temperature range</b>   | -40 °C ... +100 °C <sup>2)</sup><br>-30 °C ... +100 °C <sup>3)</sup>         |
| <b>Storage temperature range</b>     | -40 °C ... +100 °C, without package  |
| <b>Resistance to shocks</b>          | 100 g, 6 ms (EN 60068-2-27)  |
| <b>Resistance to vibration</b>       | 10 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)                                      |

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

<sup>2)</sup> Stationary position of the cable.

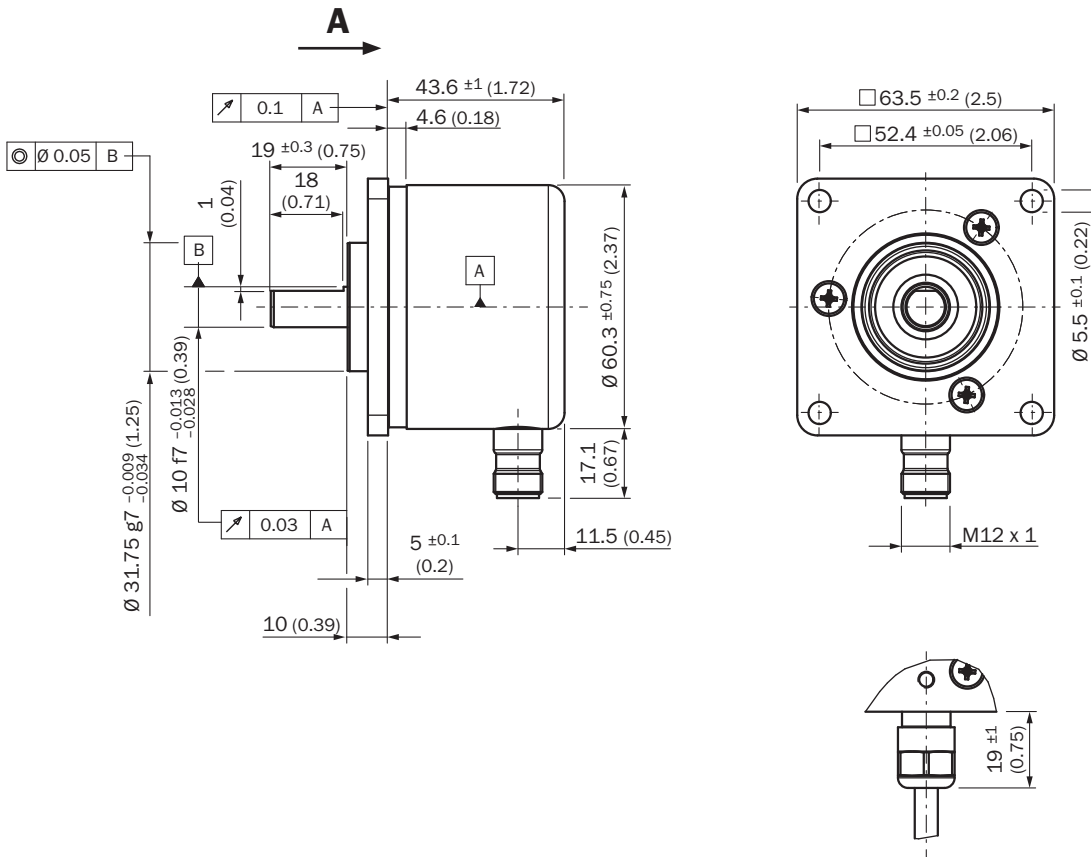
<sup>3)</sup> Flexible position of the cable.

## Classifications

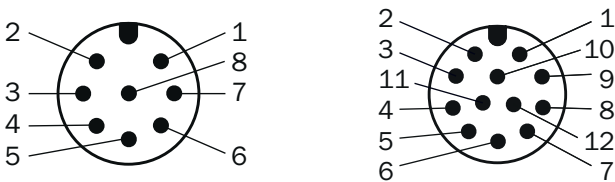
|                       |          |
|-----------------------|----------|
| <b>eCI@ss 5.0</b>     | 27270501 |
| <b>eCI@ss 5.1.4</b>   | 27270501 |
| <b>eCI@ss 6.0</b>     | 27270590 |
| <b>eCI@ss 6.2</b>     | 27270590 |
| <b>eCI@ss 7.0</b>     | 27270501 |
| <b>eCI@ss 8.0</b>     | 27270501 |
| <b>eCI@ss 8.1</b>     | 27270501 |
| <b>eCI@ss 9.0</b>     | 27270501 |
| <b>eCI@ss 10.0</b>    | 27270501 |
| <b>eCI@ss 11.0</b>    | 27270501 |
| <b>eCI@ss 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))

Solid shaft, square flange



PIN assignment



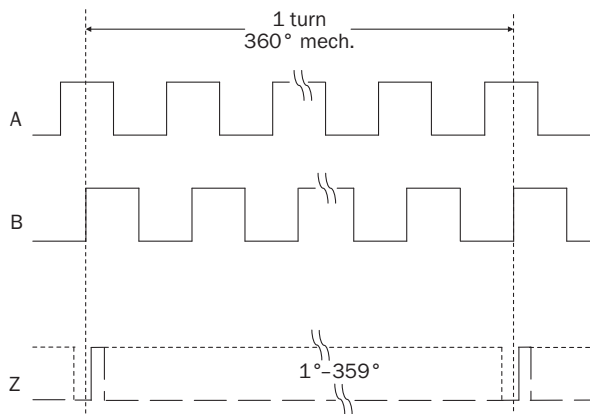
View of M12 male device connector on encoder

| Male connector M12, 8-pin | Connector M12, 12-pin | Wire colors (cable connection) | TTL/HTL signal | Sin/Cos 1.0 V <sub>PP</sub> | Explanation       |
|---------------------------|-----------------------|--------------------------------|----------------|-----------------------------|-------------------|
| 1                         | 7                     | Brown                          | $\bar{A}$      | COS-                        | Signal wire       |
| 2                         | 6                     | White                          | A              | COS+                        | Signal wire       |
| 3                         | 9                     | Black                          | $\bar{B}$      | SIN-                        | Signal wire       |
| 4                         | 8                     | Pink                           | B              | SIN+                        | Signal wire       |
| 5                         | 4                     | Yellow                         | $\bar{Z}$      | $\bar{Z}$                   | Signal wire       |
| 6                         | 11                    | Purple                         | Z              | Z                           | Signal wire       |
| 7                         | 12                    | Blue                           | GND            | GND                         | Ground connection |

| Male connector M12, 8-pin | Connector M12, 12-pin | Wire colors (cable connection) | TTL/HTL signal      | Sin/Cos 1.0 V <sub>PP</sub> | Explanation   |
|---------------------------|-----------------------|--------------------------------|---------------------|-----------------------------|---|
| 8                         | 5                     | Red                            | +U <sub>S</sub>     | +U <sub>S</sub>             | Supply voltage  |
| -                         | 2                     | -                              | N.c.                | N.c.                        | Not assigned  |
| -                         | 3                     | -                              | N.c.                | N.c.                        | Not assigned  |
| -                         | 1                     | -                              | N.c.                | N.c.                        | Not assigned  |
| -                         | 10 <sup>1)</sup>      | -                              | 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. |

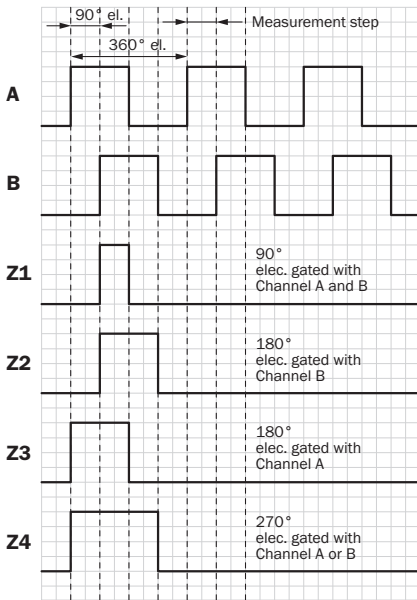
### Diagrams

Mechanical zero pulse width 1° to 359° programmable. Width of the zero pulse in relation to a mechanical revolution of the shaft.



| Supply voltage | Output               |
|----------------|----------------------|
| 4,5 V ... 32 V | TTL/HTL programmable |

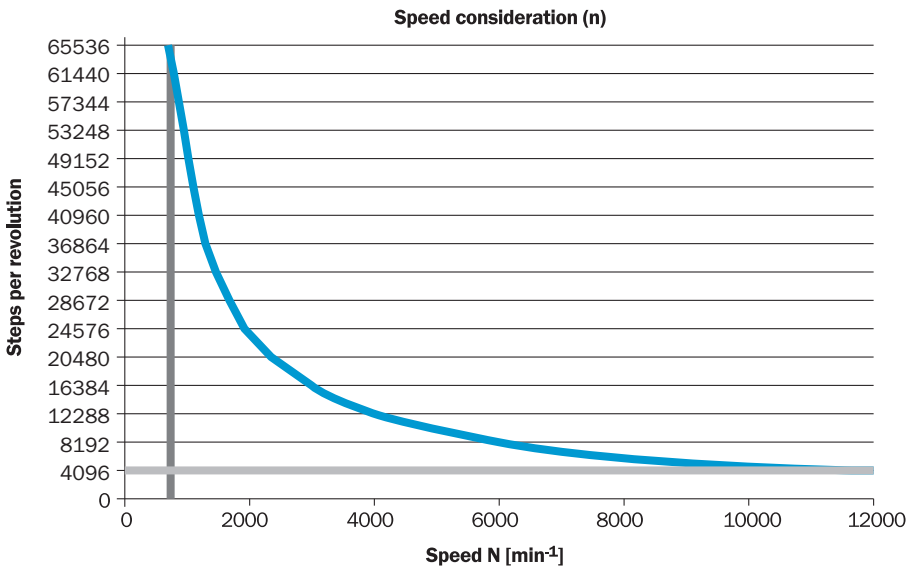
Electrical zero pulse width can be configured to 90°, 180°, or 270°. Width of the zero pulse in relation to a pulse period.



Cw with view on the encoder shaft in direction "A", compare dimensional drawing.













| Supply voltage | Output               |
|----------------|----------------------|
| 4,5 V ... 32 V | TTL/HTL programmable |

Maximum revolution range



### Recommended accessories








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

|   | Brief description   | Type             | Part no. |
|---|---|------------------|----------|
| <b>Programming and configuration tools</b>  |   |                  |          |
|    | USB programming unit, for programmable SICK encoders AFS60, AFM60, DFS60, VFS60, DFV60 and wire draw encoders with programmable encoders  | PGT-08-S         | 1036616  |
|    | Programming unit display for programmable SICK DFS60, DFV60, AFS/AFM60, AHS/AHM36 encoders, and wire draw encoder with DFS60, AFS/AFM60 and AHS/AHM36. Compact dimensions, low weight, and intuitive operation. | PGT-10-Pro       | 1072254  |
| <b>Other mounting accessories</b>   |   |                  |          |
|    | Aluminium measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 200 mm   | BEF-MR010020R    | 2055224  |
|   | Aluminium measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 300 mm   | BEF-MR010030R    | 2049278  |
|   | Measuring wheel with O-ring (NBR70) for 10 mm solid shaft, circumference 500 mm   | BEF-MR010050R    | 2055227  |
|    | Aluminum measuring wheel with cross-knurled surface for 10 mm solid shaft, circumference 200 mm   | BEF-MR10200AK    | 4084737  |
|    | Aluminum measuring wheel with smooth polyurethane surface for 10 mm solid shaft, circumference 200 mm   | BEF-MR10200AP    | 4084738  |
|   | Aluminum measuring wheel with ridged polyurethane surface for 10 mm solid shaft, circumference 200 mm   | BEF-MR10200APG   | 4084740  |
|  | Aluminum measuring wheel with studded polyurethane surface for 10 mm solid shaft, circumference 200 mm  | BEF-MR10200APN   | 4084739  |
|  | Aluminum measuring wheel with cross-knurled surface for 10 mm solid shaft, circumference 500 mm   | BEF-MR10500AK    | 4084733  |
|  | Aluminum measuring wheel with smooth polyurethane surface for 10 mm solid shaft, circumference 500 mm   | BEF-MR10500AP    | 4084734  |
|  | Aluminum measuring wheel with ridged polyurethane surface for 10 mm solid shaft, circumference 500 mm   | BEF-MR10500APG   | 4084736  |
|  | Aluminum measuring wheel with studded polyurethane surface for 10 mm solid shaft, circumference 500 mm  | BEF-MR10500APN   | 4084735  |
| <b>Plug connectors and cables</b>   |   |                  |          |
|  | Head A: female connector, M12, 12-pin, straight, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 2 m<br>Drag chain use  | DOL-1212-G02MAC1 | 6053273  |
|   | Head A: female connector, M12, 12-pin, straight, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 5 m<br>Drag chain use  | DOL-1212-G05MAC1 | 6053274  |



|  | Brief description   | Type               | Part no. |
|--|---|--------------------|----------|
|   | Head A: female connector, M12, 12-pin, straight, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 10 m<br>Drag chain use | DOL-1212-G10MAC1   | 6053275  |
|  | Head A: female connector, M12, 12-pin, straight, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 20 m<br>Drag chain use | DOL-1212-G20MAC1   | 6053276  |
|  | Head A: female connector, M12, 12-pin, angled, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 2 m                      | DOL-1212-W02MAC1   | 6039824  |
|  | Head A: female connector, M12, 12-pin, angled, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 5 m<br>Drag chain use    | DOL-1212-W05MAC1   | 6039825  |
|  | Head A: female connector, M12, 12-pin, angled, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 10 m<br>Drag chain use   | DOL-1212-W10MAC1   | 6039826  |
|  | Head A: female connector, M12, 12-pin, angled, A-coded<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 20 m<br>Drag chain use   | DOL-1212-W20MAC1   | 6039827  |
|   | Head A: female connector, M12, 8-pin, straight, A-coded<br>Cable: shielded  | YF12ES8-0050S5586A | 2097334  |
|  | Head A: male connector, M12, 8-pin, straight, A-coded<br>Cable: shielded  | YM12ES8-0050S5586A | 2097337  |

Shaft adaptation

|   |  |            |         |
|---|--|------------|---------|
|  | Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial $\pm$ 0.25 mm, axial $\pm$ 0.4 mm, angular $\pm$ 4°; max. speed 10,000 rpm, -30 °C to +120 °C, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub  | KUP-0610-B | 5312982 |
|  | Double loop coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radially $\pm$ 2,5 mm, axially $\pm$ 3 mm, angle $\pm$ 10 degrees; max. speed 3.000 rpm, -30 to +80 degrees Celsius, torsional spring stiffness of 25 Nm/rad   | KUP-0610-D | 5326697 |
|  | Spring washer coupling, shaft diameter 6 mm / 10 mm, Maximum shaft offset: radial $\pm$ 0.3 mm, axial $\pm$ 0.4 mm, angular $\pm$ 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 |
|  | Claw coupling, shaft diameter 6 mm / 10 mm, damping element 80 shore blue, maximum shaft offset: radial $\pm$ 0.22 mm, axial $\pm$ 1 mm angular $\pm$ 1.3°, 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 |
|  | Bar coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radial $\pm$ 0,3 mm, axial $\pm$ 0,3 mm, angular $\pm$ 3°; max. speed 10.000 rpm, -10° to +80 °C, max. torque: 80 Ncm, material: fiber-glass reinforced polyamide, aluminum hub  | KUP-0610-S | 2056407 |
|  | Double loop coupling, shaft diameter 8 mm / 10 mm, max. shaft offset: radially $\pm$ 0,25 mm, axially $\pm$ 0,4 mm, angle $\pm$ 4 degrees; max. speed 10.000 rpm, -30 to +120 degrees Celsius, torsional spring stiffness of 150 Nm/rad  | KUP-0810-D | 5326704 |
|  | Claw coupling, shaft diameter 8 mm / 10 mm, damping element 80 shore blue, maximum shaft offset: radial $\pm$ 0.22 mm, axial $\pm$ 1 mm angular $\pm$ 1.3°, 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 |

|   | Brief description   | Type       | Part no. |
|---|---|------------|----------|
|    | Bar coupling, shaft diameter 8 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, $-10^\circ$ to $+80^\circ$ C, max. torque: 80 Ncm, material: fiber-glass reinforced polyamide, aluminum hub   | KUP-0810-S | 5314178  |
|    | Bellows coupling, shaft diameter 10 mm/10 mm; maximum shaft offset: radial +/- 0.25 mm, axial +/- 0.4 mm, angular +/- $4^\circ$ ; max. revolutions 10,000 rpm, $-30^\circ$ to $+120^\circ$ C, max. torque 120 Ncm; material: stainless steel bellows, aluminum clamping hubs  | KUP-1010-B | 5312983  |
|    | Double loop coupling, shaft diameter 10 mm / 10 mm, Maximum shaft offset: radial +/- 2.5 mm, axial +/- 3 mm, angular +/- $10^\circ$ ; max. speed 3,000 rpm, $-30^\circ$ to $+80^\circ$ C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange   | KUP-1010-D | 5326703  |
|    | Spring washer coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset, radial $\pm 0.3$ mm, axial $\pm 0.4$ 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  |
|    | Claw coupling, shaft diameter 10 mm / 10 mm, damping element 80 shore blue, maximum shaft offset: radial $\pm 0.22$ mm, axial $\pm 1$ mm angular $\pm 1.3^\circ$ , max. speed 19,000 rpm, angle of twist max. $10^\circ$ , $-30^\circ$ C to $+80^\circ$ C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane | KUP-1010-J | 2127054  |
|    | Bar coupling, shaft diameter 10 mm / 10 mm; maximum shaft offset: radial $\pm 0.3$ mm, axial $\pm 0.2$ mm, angular $\pm 3^\circ$ ; speed 10,000 rpm, $-10^\circ$ to $+80^\circ$ Celsius, max. torque 80 Ncm; material: glass fiber-reinforced polyamide, aluminum hub   | KUP-1010-S | 2056408  |
|    | Spring washer coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset, radial $\pm 0.3$ mm, axial $\pm 0.4$ 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-W | 5319914  |
|  | 10 mm / 12 mm; maximum shaft offset: radial +/- 0.25 mm, axial +/- 0.4 mm, angular +/- $4^\circ$ ; max. revolutions 10,000 rpm, $-30^\circ$ to $+120^\circ$ C, max. torque 120 Ncm; material: stainless steel bellows, aluminum clamping hubs   | KUP-1012-B | 5312984  |
|  | Double loop coupling, shaft diameter 10 mm / 12 mm, Maximum shaft offset: radial +/- 2.5 mm, axial +/- 3 mm, angular +/- $10^\circ$ ; max. speed 3,000 rpm, $-30^\circ$ to $+80^\circ$ C, max. torque 1.5 Nm; material: polyurethane, galvanized steel flange   | KUP-1012-D | 5326702  |
|  | Claw coupling, shaft diameter 10 mm / 12 mm, damping element 80 shore blue, maximum shaft offset: radial $\pm 0.22$ mm, axial $\pm 1$ mm angular $\pm 1.3^\circ$ , max. speed 19,000 rpm, angle of twist max. $10^\circ$ , $-30^\circ$ C to $+80^\circ$ C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane | KUP-1012-J | 2128265  |

## 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.”

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