



# DFS60I-S4VC65536

DFS60

INCREMENTAL ENCODERS

**SICK**  
Sensor Intelligence.



Illustration may differ



### Ordering information

| Type             | Part no. |
|------------------|----------|
| DFS60I-S4VC65536 | 1106364  |

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 / RS-422                                                    |
| <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>Initialization time</b>             | 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.

#### Electrical data

|                        |                                     |
|------------------------|-------------------------------------|
| <b>Connection type</b> | Male connector, M12, 12-pin, radial |
| <b>Supply voltage</b>  | 4.5 ... 32 V                        |

<sup>1)</sup> Short-circuit opposite to another channel or GND permissible for maximum 30 s.

<sup>2)</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.

|                                                |                                             |
|------------------------------------------------|---------------------------------------------|
| <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)</sup>                             |
| <b>MTTFd: mean time to dangerous failure</b>   | 300 years (EN ISO 13849-1) <sup>2)</sup>    |

<sup>1)</sup> Short-circuit opposite to another channel or GND permissible for maximum 30 s.

<sup>2)</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, face mount 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>                | ≤ 9,000 min <sup>-1</sup> <sup>1)</sup> |
| <b>Moment of inertia of the rotor</b> | 6.2 gcm <sup>2</sup>                    |
| <b>Bearing lifetime</b>               | 3.6 x 10 <sup>10</sup> revolutions      |
| <b>Angular acceleration</b>           | ≤ 500,000 rad/s <sup>2</sup>            |

<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.

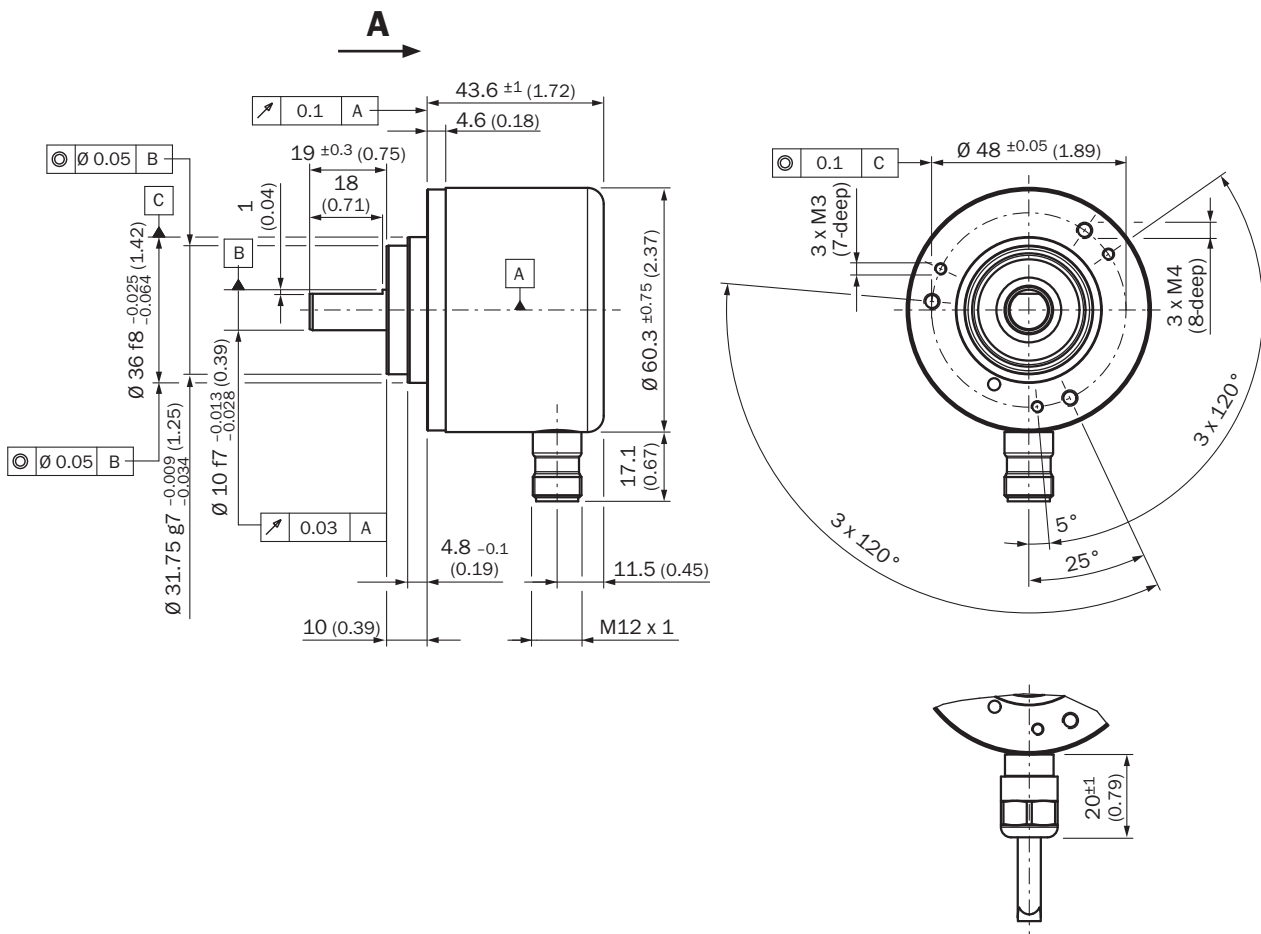
## Classifications

|                     |          |
|---------------------|----------|
| <b>eCI@ss 5.0</b>   | 27270501 |
| <b>eCI@ss 5.1.4</b> | 27270501 |

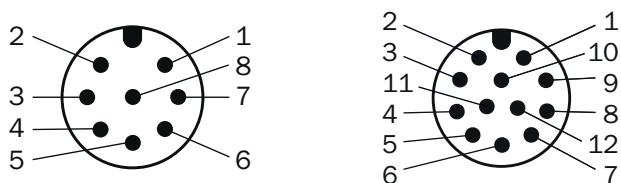
|                       |          |
|-----------------------|----------|
| <b>eCl@ss 6.0</b>     | 27270590 |
| <b>eCl@ss 6.2</b>     | 27270590 |
| <b>eCl@ss 7.0</b>     | 27270501 |
| <b>eCl@ss 8.0</b>     | 27270501 |
| <b>eCl@ss 8.1</b>     | 27270501 |
| <b>eCl@ss 9.0</b>     | 27270501 |
| <b>eCl@ss 10.0</b>    | 27270501 |
| <b>eCl@ss 11.0</b>    | 27270501 |
| <b>eCl@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, face mount flange



PIN assignment

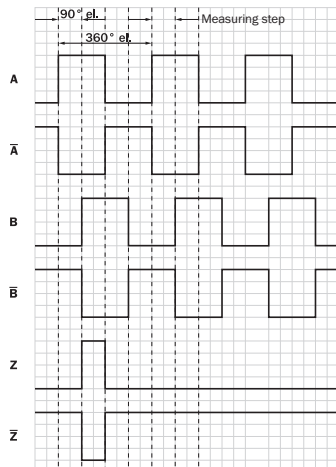


View of M12 male device connector on encoder

| 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                                                                 |
| 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>      | -                              | O-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

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](http://www.sick.com/DFS60)

|                                                                                     | Brief description                                                                                                                                | Type              | Part no. |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------|
| <b>Flanges</b>                                                                      |                                                                                                                                                  |                   |          |
|  | Flange adapter, adaptation of face mount flange with 36 mm centering hub to 58 mm square mounting plate with shock absorbers, aluminum, Aluminum | BEF-FA-036-060RSA | 2029163  |
| <b>Mounting brackets and plates</b>                                                 |                                                                                                                                                  |                   |          |
|  | Mounting bracket for encoder with spigot 36 mm for face mount flange, mounting kit included                                                      | BEF-WF-36         | 2029164  |
|  | Mounting angle spring-loaded, for flange with centering collar 36 mm, working temperature range -40° ... +120 °C, Aluminum                       | BEF-WF36F         | 4084775  |
| <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  |









|                                                                                     | Brief description                                                                                                                                                                                                                                                                                                                                                             | Type           | Part no. |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|
|    | 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  |
|   | 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  |
|  | 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 <sup>-1</sup> , axial shaft load 150 N, radial shaft load 250 N, bearing service life 3.6 x 10 <sup>9</sup> revolutions | BEF-FA-LB1210  | 2044591  |

Plug connectors and cables

|                                                                                     |                                                                                                                                                     |                  |         |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|
|  | 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 |
|                                                                                     | 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 |

|                                                                                     | Brief description                                                                                                                                                                                                                                                                                                                                                                                   | Type               | Part no. |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|
|    | 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  |
| <b>Shaft adaptation</b>                                                             |                                                                                                                                                                                                                                                                                                                                                                                                     |                    |          |
|    | Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial $\pm 0.25$ mm, axial $\pm 0.4$ mm, angular $\pm 4^\circ$ ; max. speed 10,000 rpm, $-30^\circ\text{C}$ to $+120^\circ\text{C}$ , 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 $\pm 2.5^\circ$ ; max. speed 12,000 rpm, $-10^\circ$ 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  |
|  | 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 $\pm 1.3^\circ$ , max. speed 19,000 rpm, angle of twist max. $10^\circ$ , $-30^\circ\text{C}$ 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  |
|  | 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, $-10^\circ$ to $+80^\circ\text{C}$ , 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 $\pm 1.3^\circ$ , max. speed 19,000 rpm, angle of twist max. $10^\circ$ , $-30^\circ\text{C}$ to $+80^\circ\text{C}$ , max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane | KUP-0810-J         | 2128267  |
|  | 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 $+80^\circ\text{C}$ , 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 $\pm 0.25$ mm, axial $\pm 0.4$ mm, angular $\pm 4^\circ$ ; max. revolutions 10,000 rpm, $-30^\circ$ to $+120^\circ\text{C}$ , max. torque 120 Ncm; material: stainless steel bellows, aluminum clamping hubs                                                                                                             | KUP-1010-B         | 5312983  |



|                                                                                     | Brief description                                                                                                                                                                                                                                                                                                                               | Type       | Part no. |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
|    | Double loop coupling, shaft diameter 10 mm / 10 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-1010-D | 5326703  |
|    | Spring washer coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset, radial ± 0.3 mm, axial ± 0.4 mm, angle ± 2.5°, 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 ± 0.22 mm, axial ± 1 mm angular ± 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-1010-J | 2127054  |
|    | Bar coupling, shaft diameter 10 mm / 10 mm; maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angular ± 3°; speed 10,000 rpm, -10° to +80° 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 ± 0.3 mm, axial ± 0.4 mm, angle ± 2.5°, 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°; max. revolutions 10,000 rpm, -30° to +120 °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°; max. speed 3,000 rpm, -30° to +80 °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 ± 0.22 mm, axial ± 1 mm angular ± 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-1012-J | 2128265  |

## SICK AT A GLANCE

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