



# DFS60S-S10A01024

DFS60S Pro

SAFETY ENCODERS

**SICK**  
Sensor Intelligence.



Illustration may differ



## Ordering information

| Type             | Part no. |
|------------------|----------|
| DFS60S-S10A01024 | 1069522  |

Other models and accessories → [www.sick.com/DFS60S\\_Pro](http://www.sick.com/DFS60S_Pro)

## Detailed technical data

### Safety-related parameters

|                                                                   |                                                    |
|-------------------------------------------------------------------|----------------------------------------------------|
| <b>Safety integrity level</b>                                     | SIL2 (IEC 61508), SILCL2 (IEC 62061) <sup>1)</sup> |
| <b>Performance level</b>                                          | PL d (EN ISO 13849) <sup>1)</sup>                  |
| <b>Category</b>                                                   | 3 (EN ISO 13849)                                   |
| <b>PFH<sub>D</sub>: Probability of dangerous failure per hour</b> | $1.7 \times 10^{-8}$ <sup>2)</sup>                 |
| <b>T<sub>M</sub> (mission time)</b>                               | 20 years (EN ISO 13849)                            |
| <b>Safety-related measuring step</b>                              | 0.09°, Quadrature analysis                         |
| <b>Safety-related accuracy</b>                                    | ± 0.09°                                            |

<sup>1)</sup> For more detailed information on the exact configuration of your machine/unit, please consult your relevant SICK branch office.

<sup>2)</sup> The values displayed apply to a diagnostic degree of coverage of 99%, which must be achieved by the external drive system and 95 °C operating temperature.

### Performance

|                                           |                                                                                       |
|-------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Sine/cosine periods per revolution</b> | 1,024                                                                                 |
| <b>Measuring step</b>                     | 0.3°, For interpolation of the sine/cosine signals with, e. g., 12 bits <sup>1)</sup> |
| <b>Initialization time</b>                | 50 ms <sup>2)</sup>                                                                   |
| <b>Integral non-linearity</b>             | Typ. ± 45 Winkelsekunden (without mechanical tension of the stator coupling)          |
| <b>Differential non-linearity</b>         | ± 7 Winkelsekunden                                                                    |
| <b>Reference signal, number</b>           | 1                                                                                     |
| <b>Reference signal, position</b>         | 90°, electronically, gated with Sinus and Cosinus                                     |

<sup>1)</sup> Not safety-related.

<sup>2)</sup> Valid signals can be read once this time has elapsed.

## Electrical data

|                                            |                                     |
|--------------------------------------------|-------------------------------------|
| <b>Communication interface</b>             | Incremental                         |
| <b>Communication Interface detail</b>      | Sin/Cos <sup>1)</sup>               |
| <b>Connection type</b>                     | Male connector, M23, 12-pin, radial |
| <b>Supply voltage</b>                      | 4.5 V ... 32 V                      |
| <b>Maximum output frequency</b>            | ≤ 153.6 kHz                         |
| <b>Load resistance</b>                     | ≥ 120 Ω                             |
| <b>Power consumption max. without load</b> | ≤ 0.7 W                             |
| <b>Power consumption</b>                   | Without load                        |
| <b>Reverse polarity protection</b>         | ✓                                   |
| <b>Protection class</b>                    | III (according to DIN EN 61140)     |
| <b>Short-circuit protection</b>            | ✓ <sup>2)</sup>                     |

<sup>1)</sup> 1.0 V<sub>SS</sub> (differential).

<sup>2)</sup> Short-circuit to another channel or GND permitted for max. 30 s. In the case of U<sub>S</sub> ≤ 12 V additional short-circuit to U<sub>S</sub> permitted for max. 30 s.

## Mechanical data

|                                           |                                                 |
|-------------------------------------------|-------------------------------------------------|
| <b>Mechanical design</b>                  | Solid shaft, Servo flange                       |
| <b>Shaft diameter</b>                     | 6 mm                                            |
| <b>Shaft length</b>                       | 10 mm                                           |
| <b>Shaft material</b>                     | Stainless steel                                 |
| <b>Flange material</b>                    | Aluminum                                        |
| <b>Housing material</b>                   | Aluminum die cast                               |
| <b>Weight</b>                             | Approx. 0.3 kg <sup>1)</sup>                    |
| <b>Start up torque</b>                    | ≤ 0.5 Ncm (at 20 °C)                            |
| <b>Operating torque</b>                   | ≤ 0.3 Ncm (at 20 °C)                            |
| <b>Permissible Load capacity of shaft</b> | 80 N (radial)<br>40 N (axial)                   |
| <b>Max. angular acceleration</b>          | ≤ 500,000 rad/s <sup>2</sup>                    |
| <b>Operating speed</b>                    | 9,000 min <sup>-1</sup> <sup>2)</sup>           |
| <b>Moment of inertia of the rotor</b>     | 8 gcm <sup>2</sup>                              |
| <b>Bearing lifetime</b>                   | 3.6 x 10 <sup>9</sup> revolutions <sup>3)</sup> |

<sup>1)</sup> Relates to encoders with male connector.

<sup>2)</sup> Allow for self-heating of approx. 3.0 K per 1,000 rpm regarding the permissible operating temperature.

<sup>3)</sup> On maximum operating speed and temperature.

## Ambient data

|                                      |                                                           |
|--------------------------------------|-----------------------------------------------------------|
| <b>EMC</b>                           | According to EN 61000-6-2, EN 61000-6-3 and IEC 61326-3-1 |
| <b>Enclosure rating</b>              | IP65 (according to IEC 60529) <sup>1)</sup>               |
| <b>Permissible relative humidity</b> | 90 %, Condensation not permitted                          |
| <b>Operating temperature range</b>   | -30 °C ... +95 °C <sup>2)</sup>                           |

<sup>1)</sup> With male connector and mating connector fitted minimum IP65.

<sup>2)</sup> At operating temperature measuring point.

<sup>3)</sup> Checked during operation using vector length monitoring.

<sup>4)</sup> Checked to operation with vector length monitoring. Including mating connector.

|                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <b>Storage temperature range</b>                   | -30 °C ... +90 °C, without package                     |
| <b>Resistance to shocks</b>                        | 100 g, 6 ms (according to EN 60068-2-27) <sup>3)</sup> |
| <b>Frequency range of resistance to vibrations</b> | 10 g, 10 Hz ... 1,000 Hz (EN 60068-2-6) <sup>4)</sup>  |

<sup>1)</sup> With male connector and mating connector fitted minimum IP65.

<sup>2)</sup> At operating temperature measuring point.

<sup>3)</sup> Checked during operation using vector length monitoring.

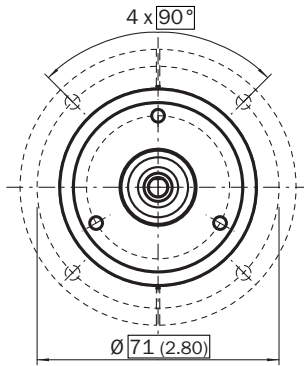
<sup>4)</sup> Checked to operation with vector length monitoring. Including mating connector.

## Classifications

|                       |          |
|-----------------------|----------|
| <b>ECl@ss 5.0</b>     | 27272501 |
| <b>ECl@ss 5.1.4</b>   | 27272501 |
| <b>ECl@ss 6.0</b>     | 27272590 |
| <b>ECl@ss 6.2</b>     | 27272590 |
| <b>ECl@ss 7.0</b>     | 27272590 |
| <b>ECl@ss 8.0</b>     | 27272590 |
| <b>ECl@ss 8.1</b>     | 27272590 |
| <b>ECl@ss 9.0</b>     | 27272590 |
| <b>ECl@ss 10.0</b>    | 27272501 |
| <b>ECl@ss 11.0</b>    | 27272501 |
| <b>ETIM 5.0</b>       | EC001486 |
| <b>ETIM 6.0</b>       | EC001486 |
| <b>ETIM 7.0</b>       | EC001486 |
| <b>UNSPSC 16.0901</b> | 41112113 |



Mounting requirements for half-shell servo clamp

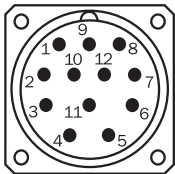


All dimensions in mm (inch)

Part no. 2029165

## PIN assignment

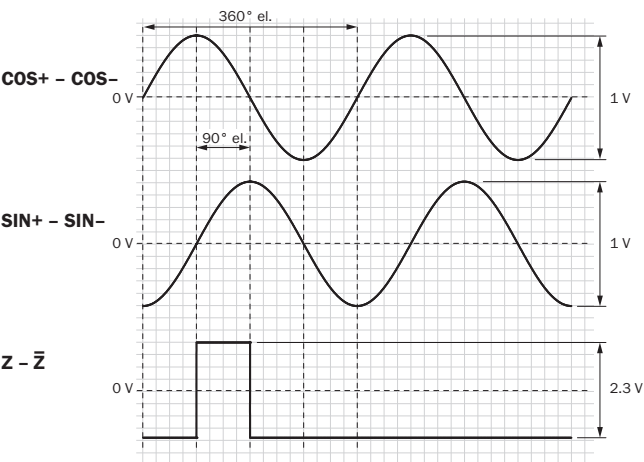
View of M23 male device connector on encoder



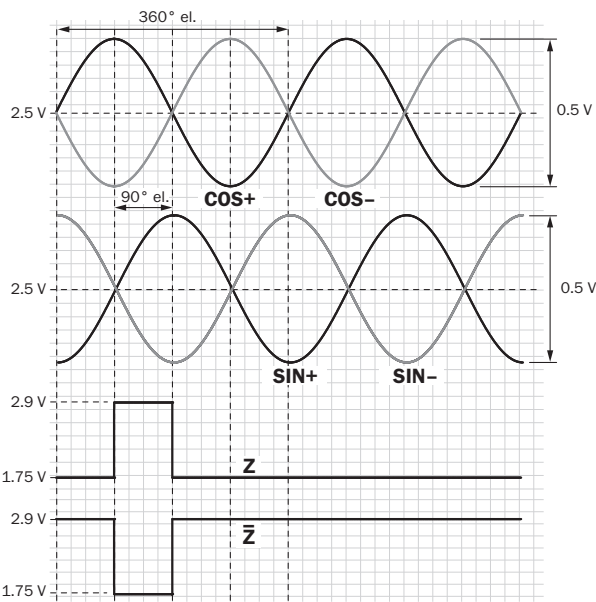
| PIN | Wire colors (cable connection) | Signal       | Explanation                                                                       |
|-----|--------------------------------|--------------|-----------------------------------------------------------------------------------|
| 1   | Red                            | $U_S$        | Operating voltage                                                                 |
| 2   | Blue                           | GND          | Ground connection                                                                 |
| 3   | Yellow                         | Clock +      | Interface signals                                                                 |
| 4   | White                          | Data +       | Interface signals                                                                 |
| 5   | Orange                         | SET          | Electronic adjustment                                                             |
| 6   | Brown                          | Data -       | Interface signals                                                                 |
| 7   | Violet                         | Clock -      | Interface signals                                                                 |
| 8   | Black                          | - SIN        | Signal wire                                                                       |
| 9   | Orange-black                   | CW/CCW (V/R) | Sequence in direction of rotation                                                 |
| 10  | Green                          | - COS        | Signal wire                                                                       |
| 11  | Gray                           | + COS        | Signal wire                                                                       |
| 12  | Pink                           | + SIN        | Signal wire                                                                       |
|     |                                | Screen       | Screen connected to housing on encoder side. Connected to ground on control side. |

Diagrams

Signal SIN/COS after differential generation



For clockwise shaft rotation, looking in direction “A” (see dimensional drawing)  
Signal SIN/COS before differential generation

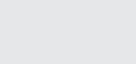


For clockwise shaft rotation, looking in direction “A” (see dimensional drawing)

Recommended accessories

Other models and accessories → [www.sick.com/DFS60S\\_Pro](http://www.sick.com/DFS60S_Pro)

|                                                                                     | Brief description                                                             | Type         | Part no. |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------|----------|
| Other mounting accessories                                                          |                                                                               |              |          |
|  | Half-shell servo clamps (2 pcs.) for servo flanges with a 50 mm centering hub | BEF-WG-SF050 | 2029165  |

|                                                                                     | Brief description                                                                                                                 | Type             | Part no. |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------|----------|
|    | Servo clamps, large, for servo flanges (clamps, eccentric fastener), 3 pcs., without mounting material, without mounting hardware | BEF-WK-SF        | 2029166  |
| Plug connectors and cables                                                          |                                                                                                                                   |                  |          |
|    | Head A: cable<br>Head B: Flying leads<br>Cable: SSI, Incremental, HIPERFACE®, PUR, halogen-free, shielded                         | LTG-2308-MWENC   | 6027529  |
|    | Head A: cable<br>Head B: Flying leads<br>Cable: SSI, Incremental, PUR, shielded                                                   | LTG-2411-MW      | 6027530  |
|    | Head A: cable<br>Head B: Flying leads<br>Cable: SSI, Incremental, PUR, halogen-free, shielded                                     | LTG-2512-MW      | 6027531  |
|    | Head A: cable<br>Head B: Flying leads<br>Cable: SSI, TTL, HTL, Incremental, PUR, halogen-free, shielded                           | LTG-2612-MW      | 6028516  |
|    | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 2 m                 | DOL-2312-G02MLA3 | 2030682  |
|    | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 3 m   | DOL-2312-G03MMA3 | 2029213  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 5 m   | DOL-2312-G05MMA3 | 2029214  |
|                                                                                     | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 7 m                 | DOL-2312-G07MLA3 | 2030685  |
|                                                                                     | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 10 m                | DOL-2312-G10MLA3 | 2030688  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 10 m  | DOL-2312-G10MMA3 | 2029215  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 15 m                | DOL-2312-G15MLA3 | 2030692  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 1.5 m | DOL-2312-G1M5MA3 | 2029212  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 20 m                | DOL-2312-G20MLA3 | 2030695  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 20 m  | DOL-2312-G20MMA3 | 2029216  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 25 m                | DOL-2312-G25MLA3 | 2030699  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, shielded, 30 m                | DOL-2312-G30MLA3 | 2030702  |
|                                                                                     | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: Incremental, PUR, halogen-free, shielded, 30 m  | DOL-2312-G30MMA3 | 2029217  |

|                                                                                   | Brief description                                                                                           | Type         | Part no. |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------|----------|
|  | Head A: male connector, M23, 12-pin, straight<br>Head B: -<br>Cable: HIPERFACE®, SSI, Incremental, shielded | STE-2312-G01 | 2077273  |

## SICK AT A GLANCE

SICK is one of the leading manufacturers of intelligent sensors and sensor solutions for industrial applications. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

We have extensive experience in a wide range of industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

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

For us, that is “Sensor Intelligence.”

## WORLDWIDE PRESENCE:

Contacts and other locations –[www.sick.com](http://www.sick.com)