



# AFS60E-S4AA004096

AFS/AFM60 SSI

**ABSOLUTE ENCODERS**

**SICK**  
Sensor Intelligence.



Illustration may differ



### Ordering information

| Type              | Part no. |
|-------------------|----------|
| AFS60E-S4AA004096 | 1037630  |

Other models and accessories → [www.sick.com/AFS\\_AFM60\\_SSI](http://www.sick.com/AFS_AFM60_SSI)

### Detailed technical data

#### Performance

|   |                      |
|---|----------------------|
| <b>Number of steps per revolution (max. resolution)</b>       | 4,096 (12 bit)       |
| <b>Error limits G</b>   | 0.2° <sup>1)</sup>   |
| <b>Repeatability standard deviation <math>\sigma_r</math></b> | 0.002° <sup>2)</sup> |

<sup>1)</sup> In accordance with DIN ISO 1319-1, position of the upper and lower error limit depends on the installation situation, specified value refers to a symmetrical position, i.e. deviation in upper and lower direction is the same.

<sup>2)</sup> In accordance with DIN ISO 55350-13; 68.3% of the measured values are inside the specified area.

#### Interfaces

|  |  |
|--|--|
| <b>Communication interface</b>                 | SSI  |
| <b>Initialization time</b>                     | 50 ms <sup>1)</sup>                                  |
| <b>Position forming time</b>                   | < 1 $\mu$ s  |
| <b>Code type</b>                               | Gray   |
| <b>Code sequence parameter adjustable</b>      | CW/CCW (V/R) parameter adjustable                    |
| <b>Clock frequency</b>                         | $\leq 1$ MHz <sup>2)</sup>                           |
| <b>Set (electronic adjustment)</b>             | H-active (L = 0 - 3 V, H = 4,0 - U <sub>s</sub> V)   |
| <b>CW/CCW (counting sequence when turning)</b> | L-active (L = 0 - 1,5 V, H = 2,0 - U <sub>s</sub> V) |

<sup>1)</sup> Valid positional data can be read once this time has elapsed.

<sup>2)</sup> Minimum, LOW level (Clock +): 250 ns.

#### Electrical data

|   |  |
|---|--|
| <b>Connection type</b>                      | Male connector, M23, 12-pin, radial      |
| <b>Supply voltage</b>                       | 4.5 ... 32 V                             |
| <b>Power consumption</b>                    | $\leq 0.7$ W (without load)              |
| <b>Reverse polarity protection</b>          | ✓  |
| <b>MTTF: mean time to dangerous failure</b> | 250 years (EN ISO 13849-1) <sup>1)</sup> |

<sup>1)</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>                         | 0.3 kg <sup>1)</sup>                    |
| <b>Shaft material</b>                 | Stainless steel                         |
| <b>Flange material</b>                | Aluminum                                |
| <b>Housing material</b>               | Aluminum die cast                       |
| <b>Start up torque</b>                | < 0.5 Ncm (+20 °C)                      |
| <b>Operating torque</b>               | < 0.3 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>2)</sup> |
| <b>Moment of inertia of the rotor</b> | 6.2 gcm <sup>2</sup>                    |
| <b>Bearing lifetime</b>               | 3.0 x 10 <sup>9</sup> revolutions       |
| <b>Angular acceleration</b>           | ≤ 500,000 rad/s <sup>2</sup>            |

<sup>1)</sup> Based on devices with male connector.

<sup>2)</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 <sup>1)</sup>                     |
| <b>Enclosure rating</b>              | IP65, shaft side (IEC 60529)<br>IP67, housing side (IEC 60529) <sup>2)</sup> |
| <b>Permissible relative humidity</b> | 90 % (Condensation not permitted)  |
| <b>Operating temperature range</b>   | 0 °C ... +85 °C  |
| <b>Storage temperature range</b>     | -40 °C ... +100 °C, without package  |
| <b>Resistance to shocks</b>          | 50 g, 6 ms (EN 60068-2-27)   |
| <b>Resistance to vibration</b>       | 20 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)                                      |

<sup>1)</sup> EMC according to the standards quoted is achieved if shielded cables are used.

<sup>2)</sup> For devices with male connector: with mounted mating connector.

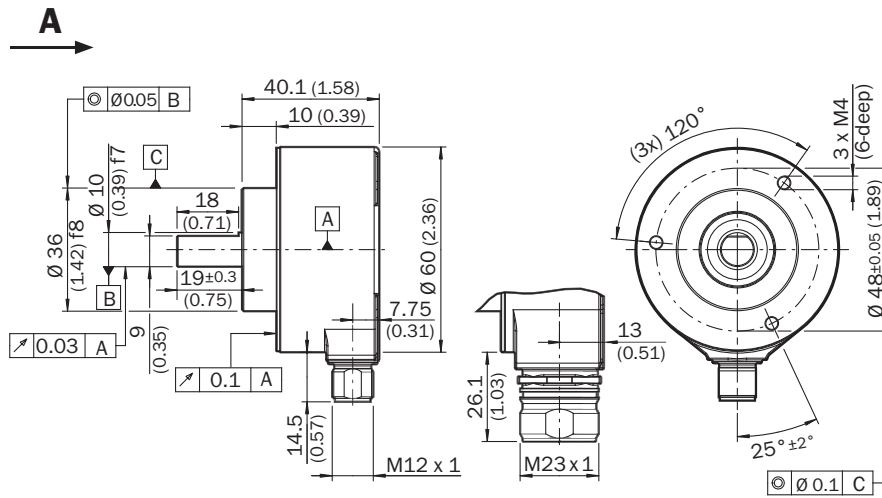
## Classifications

|                     |          |
|---------------------|----------|
| <b>eCl@ss 5.0</b>   | 27270502 |
| <b>eCl@ss 5.1.4</b> | 27270502 |
| <b>eCl@ss 6.0</b>   | 27270590 |
| <b>eCl@ss 6.2</b>   | 27270590 |
| <b>eCl@ss 7.0</b>   | 27270502 |
| <b>eCl@ss 8.0</b>   | 27270502 |
| <b>eCl@ss 8.1</b>   | 27270502 |
| <b>eCl@ss 9.0</b>   | 27270502 |
| <b>eCl@ss 10.0</b>  | 27270502 |
| <b>eCl@ss 11.0</b>  | 27270502 |
| <b>eCl@ss 12.0</b>  | 27270502 |

|                       |          |
|-----------------------|----------|
| <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))

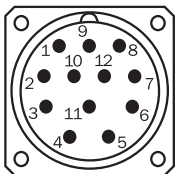
Face mount flange, M12 and M23 radial male connector



General tolerances according to DIN ISO 2768-mk

### PIN assignment

M23 male connector, 12-pin, SSI/Gray

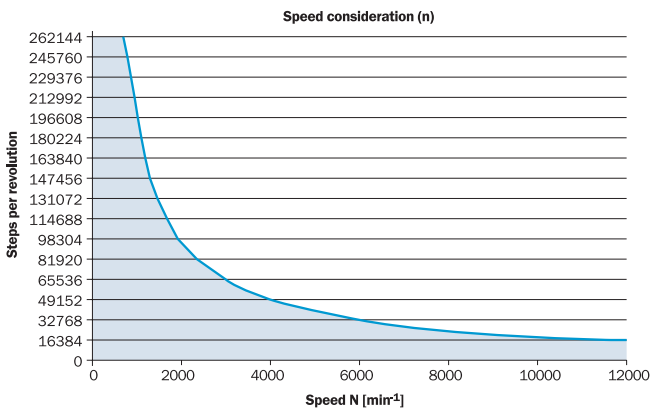


View of M23 male device connector on encoder

| PIN | Signal         | Explanation       |
|-----|----------------|-------------------|
| 1   | GND            | Ground connection |
| 2   | Data +         | Interface signals |
| 3   | Clock +        | Interface signals |
| 4   | N.C.           | Not assigned      |
| 5   | N.C.           | Not assigned      |
| 6   | N.C.           | Not assigned      |
| 7   | N.C.           | Not assigned      |
| 8   | U <sub>s</sub> | Operating voltage |

| PIN | Signal  | Explanation   |
|-----|---------|---|
| 9   | SET     | Electronic adjustment   |
| 10  | Data -  | Interface signals   |
| 11  | Clock - | Interface signals   |
| 12  | V/R     | Sequence in direction of rotation   |
|     | Screen  | Screen connected to housing on encoder side. Connected to ground on control side. |





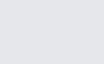
### Diagrams










The maximum speed is also dependent on the shaft type.

### Recommended accessories

Other models and accessories → [www.sick.com/AFS\\_AFM60\\_SSI](http://www.sick.com/AFS_AFM60_SSI)

|   | Brief description  | Type             | Part no. |
|---|--|------------------|----------|
| <b>Flanges</b>  |  |                  |          |
|  | Flange adapter, adaptation of face mount flange with 36 mm centering hub to 100 mm servo flange with 60 mm centering hub, aluminum, Aluminum | BEF-FA-036-100   | 2029161  |
| <b>Other mounting accessories</b>   |  |                  |          |
|  | Servo clamps, large, for servo flange (clamps, eccentric fastener), 3 pcs, without mounting material, without mounting hardware              | BEF-WK-SF        | 2029166  |
| <b>Plug connectors and cables</b>   |  |                  |          |
|  | Head A: cable<br>Head B: Flying leads<br>Cable: SSI, Incremental, HIPERFACE®, PUR, halogen-free, shielded                                    | LTG-2308-MWENC   | 6027529  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 3 m                      | DOL-2308-G03MAA6 | 2048597  |
|  | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 5 m                      | DOL-2308-G05MAA6 | 2048598  |

|   | Brief description   | Type             | Part no. |
|---|---|------------------|----------|
|    | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 0.5 m   | DOL-2308-G0M5AA6 | 2048595  |
|   | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 10 m  | DOL-2308-G10MAA6 | 2048599  |
|   | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: SSI, PUR, halogen-free, shielded, 1.5 m   | DOL-2308-G1M5AA6 | 2048596  |
|   | Head A: female connector, M23, 9-pin, straight<br>Cable: HIPERFACE <sup>®</sup> , SSI, Incremental, shielded  | DOS-2309-G       | 6028533  |
|   | Head A: female connector, M23, 12-pin, straight<br>Cable: HIPERFACE <sup>®</sup> , SSI, Incremental, shielded   | DOS-2312-G       | 6027538  |
|   |   | DOS-2312-G02     | 2077057  |
|    | Head A: female connector, M23, 12-pin, angled<br>Cable: HIPERFACE <sup>®</sup> , SSI, Incremental, shielded   | DOS-2312-W01     | 2072580  |
| <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  |
|  | Double loop coupling, shaft diameter 10 mm / 10 mm, Maximum shaft offset: radial $\pm 2.5$ mm, axial $\pm 3$ mm, angular $\pm 10^\circ$ ; max. speed 3,000 rpm, $-30^\circ$ to $+80^\circ\text{C}$ , max. torque 1.5 Nm; material: polyurethane, galvanized steel flange  | KUP-1010-D       | 5326703  |

|   | Brief description   | Type       | Part no. |
|---|---|------------|----------|
|  | 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 $\pm 1.5$ mm, axial $\pm 1.0$ mm, angle $\pm 5^\circ$ , 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 $\pm 0.25$ mm, axial $\pm 0.4$ mm, angular $\pm 4^\circ$ ; 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 $\pm 2.5$ mm, axial $\pm 3$ mm, angular $\pm 10^\circ$ ; 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  |

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