



# AFS60B-S4AM004096

AFS/AFM60 SSI

**ABSOLUTE ENCODERS**

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Sensor Intelligence.

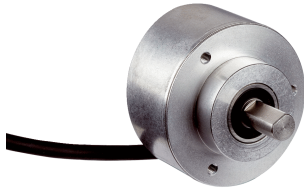


Illustration may differ



### Ordering information

| Type              | Part no. |
|-------------------|----------|
| AFS60B-S4AM004096 | 1122540  |

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>                                         | 0.05° <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>                         | $\leq$ 2 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>                       | Cable, 8-wire, universal, 5 m <sup>1)</sup> |
| <b>Supply voltage</b>                        | 4.5 ... 32 V                                |
| <b>Power consumption</b>                     | $\leq$ 0.7 W (without load)                 |
| <b>Reverse polarity protection</b>           | ✓                                           |
| <b>MTTFd: mean time to dangerous failure</b> | 250 years (EN ISO 13849-1) <sup>2)</sup>    |

<sup>1)</sup> The universal cable connection is positioned so that it is possible to lay it without bends in a radial or axial direction.

<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>                         | 0.3 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> 2)      |
| <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>   | -40 °C ... +100 °C <sup>3)</sup>                                             |
| <b>Storage temperature range</b>     | -40 °C ... +100 °C, without package                                          |
| <b>Resistance to shocks</b>          | 70 g, 6 ms (EN 60068-2-27)                                                   |
| <b>Resistance to vibration</b>       | 30 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.

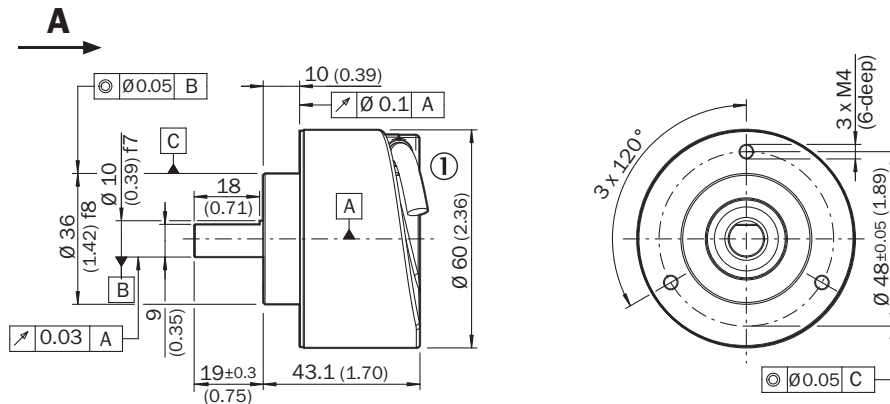
<sup>3)</sup> Stationary position of the cable.

## Classifications

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

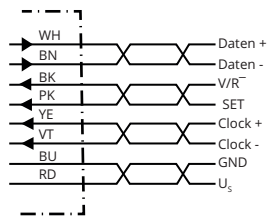
|                       |          |
|-----------------------|----------|
| <b>ETIM 5.0</b>       | EC001486 |
| <b>ETIM 6.0</b>       | EC001486 |
| <b>ETIM 7.0</b>       | EC001486 |
| <b>ETIM 8.0</b>       | EC001486 |
| <b>UNSPSC 16.0901</b> | 41112113 |

### Dimensional drawing (Dimensions in mm (inch))



① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

### PIN assignment



| PIN | Wire colors (cable connection) | Signal         | Explanation                                                                       |
|-----|--------------------------------|----------------|-----------------------------------------------------------------------------------|
| 1   | Brown                          | Data -         | Interface signals                                                                 |
| 2   | White                          | Data +         | Interface signals                                                                 |
| 3   | Black                          | V/R            | Sequence in direction of rotation                                                 |
| 4   | Pink                           | SET            | Electronic adjustment<br>Interface signals                                        |
| 5   | Yellow                         | Clock +        | Interface signals                                                                 |
| 6   | Purple                         | Clock -        | Interface signals                                                                 |
| 7   | Blue                           | GND            | Ground connection                                                                 |
| 8   | Red                            | U <sub>S</sub> | Operating voltage                                                                 |
|     |                                | 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>Shaft adaptation</b>                                                             |                                                                                                                                                                                                                                                                                                                                                |                |          |
|  | Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular +/- 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 +/- 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  |
|  | 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  |
|  | Claw coupling, shaft diameter 6 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-0610-J     | 2127056  |
|  | Bar coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radial ± 0,3 mm, axial ± 0,3 mm, angular ± 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  |

|                                                                                     | Brief description                                                                                                                                                                                                                                                                                                                                                                                                              | Type       | Part no. |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
|    | Double loop coupling, shaft diameter 8 mm / 10 mm, max. shaft offset: radially +/- 0,25 mm, axially +/-0,4 mm, angle +/- 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 °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  |
|    | 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° to +80 °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°; max. revolutions 10,000 rpm, -30° to +120 °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°; 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 $\pm 0.3$ 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 °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 $\pm 0.3$ mm, axial $\pm 0.2$ mm, angular $\pm 3^\circ$ ; speed 10,000 rpm, -10° to +80° Celsius, max. torque 80 Ncm; material: glass fiber-reinforced polyamide, aluminum hub                                                                                                                                                                        | KUP-1010-S | 2056408  |
|  | Spring coupling, shaft diameter 10 mm / 10 mm, maximum shaft offset: radial $\pm 1.5$ mm, axial $\pm 1.0$ mm, angular $\pm 5^\circ$ , max. speed 3,000 rpm, -30° to +120 °Celsius, nominal torque 150 Ncm, rotational angle at half nominal torque, direction of rotation right viewed on driving shaft $40^\circ$ , left viewed on driving shaft $60^\circ$ , material: spring steel 1.0600 nickel plated, zinc die cast hubs | 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 $\pm 0.22$ mm, axial $\pm 1$ mm angular $\pm 1.3^\circ$ , max. speed 19,000 rpm, angle of twist max. $10^\circ$ , -30 °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  |
| <b>Others</b>                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                |            |          |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Male connector, M23, 12-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE<sup>®</sup>, SSI, Incremental, RS-422</li> <li>• <b>Description:</b> HIPERFACE<sup>®</sup>, SSI, Incremental, RS-422, shielded, M23 male connector</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>                                          | STE-2312-G | 6027537  |

|                                                                                   | Brief description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Type          | Part no. |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Male connector, M23, 12-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE<sup>®</sup>, SSI, Incremental</li> <li>• <b>Description:</b> HIPERFACE<sup>®</sup>, SSI, Incremental, shielded, M23 female connector with central fixing ( for cabinet bushing )</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>                                                                                                                                                           | STE-2312-GX   | 6028548  |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Male connector, M23, 12-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE<sup>®</sup>, SSI, Incremental</li> <li>• <b>Description:</b> HIPERFACE<sup>®</sup>, SSI, Incremental, shielded, Head A: male connector, M23, 12-pin, straight, for cable diameter 5.5 mm ... 10.5 mm Head B: - Operating temperature: -40 °C ... +125 °C</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>                                                                                   | STE-2312-G01  | 2077273  |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Male connector, M12, 8-pin, straight, A-coded</li> <li>• <b>Signal type:</b> Incremental</li> <li>• <b>Cable:</b> CAT5, CAT5e</li> <li>• <b>Description:</b> Incremental, shielded, Head A: male connector, M12, 8-pin, straight, A coded, shielded, for cable diameter 4 mm ... 8 mm Head B: - Operating temperature: -40 °C ... +85 °C</li> <li>• <b>Connection systems:</b> IDC quick connection</li> <li>• <b>Permitted cross-section:</b> 0.14 mm<sup>2</sup> ... 0.34 mm<sup>2</sup></li> </ul> | STE-1208-GA01 | 6044892  |

## SICK AT A GLANCE

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