



# AFM60E-S1TA000512

AFS/AFM60 SSI

**ABSOLUTE ENCODERS**

**SICK**  
Sensor Intelligence.



Illustration may differ



### Ordering information

| Type              | Part no. |
|-------------------|----------|
| AFM60E-S1TA000512 | 1062432  |

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>                         | 512 (9 bit)                  |
| <b>Number of revolutions</b>  | 4,096 (12 bit)               |
| <b>Max. resolution (number of steps per revolution x number of revolutions)</b> | 9 bit x 12 bit (512 x 4,096) |
| <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>Communication Interface detail</b>          | SSI + incremental / TTL                              |
| <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) |
| <b>Pulses per revolution</b>                   | 1/4 of number of SSI steps per revolution            |
| <b>Output frequency</b>                        | $\leq 300$ kHz                                       |
| <b>Load current</b>                            | $\leq 30$ mA   |

<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>                     | ≤ 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>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, Servo flange               |
| <b>Shaft diameter</b>                 | 6 mm                                    |
| <b>Shaft length</b>                   | 10 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.

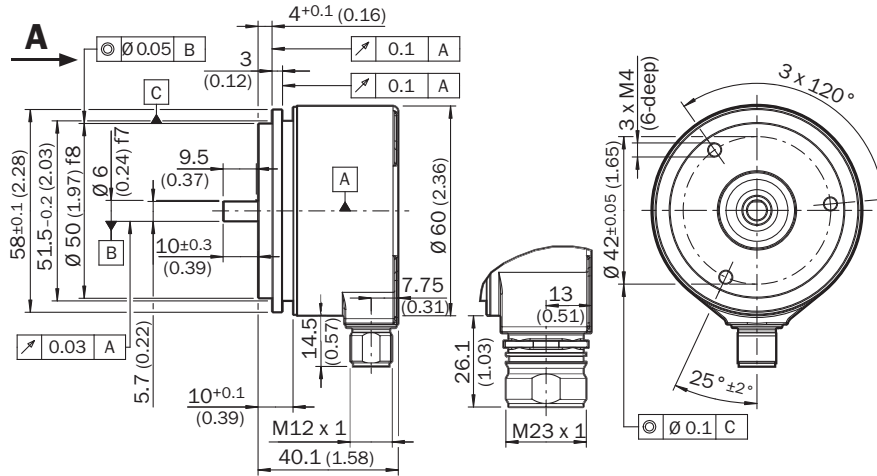
## Classifications

|                     |          |
|---------------------|----------|
| <b>eCl@ss 5.0</b>   | 27270502 |
| <b>eCl@ss 5.1.4</b> | 27270502 |
| <b>eCl@ss 6.0</b>   | 27270590 |

|                |          |
|----------------|----------|
| eCl@ss 6.2     | 27270590 |
| eCl@ss 7.0     | 27270502 |
| eCl@ss 8.0     | 27270502 |
| eCl@ss 8.1     | 27270502 |
| eCl@ss 9.0     | 27270502 |
| eCl@ss 10.0    | 27270502 |
| eCl@ss 11.0    | 27270502 |
| eCl@ss 12.0    | 27270502 |
| ETIM 5.0       | EC001486 |
| ETIM 6.0       | EC001486 |
| ETIM 7.0       | EC001486 |
| ETIM 8.0       | EC001486 |
| UNSPSC 16.0901 | 41112113 |

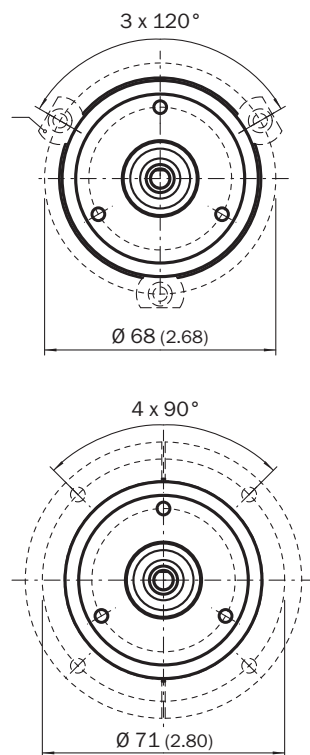
### Dimensional drawing (Dimensions in mm (inch))

Servo flange, M12 and M23 radial male connector



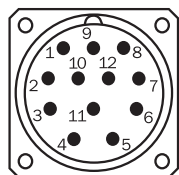
General tolerances according to DIN ISO 2768-mk

Attachment specifications



PIN assignment

M23 male connector, 12-pin and cable, 12-wire, SSI/Gray + incremental

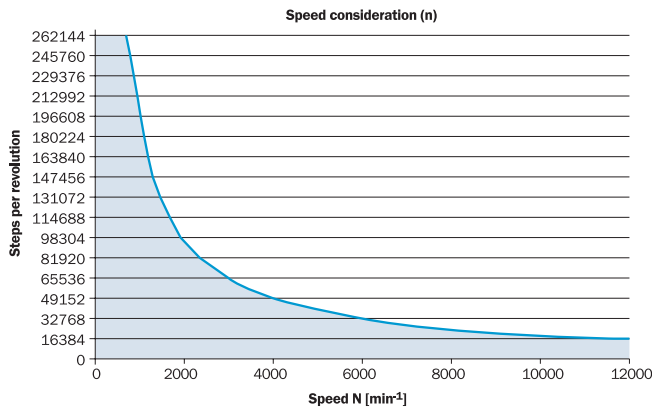


View of M23 male device connector on encoder

| PIN | Wire colors (cable connection) | Signal Sin/Cos | Explanation                       |
|-----|--------------------------------|----------------|-----------------------------------|
| 1   | Red                            | U <sub>S</sub> | 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                          | $\bar{B}$      | Signal wire                       |
| 9   | Orange-black                   | CW/CCW (V/R)   | Sequence in direction of rotation |
| 10  | Green                          | $\bar{A}$      | Signal wire                       |
| 11  | Gray                           | A              | Signal wire                       |

| PIN | Wire colors (cable connection) | Signal Sin/Cos | Explanation   |
|-----|--------------------------------|----------------|---|
| 12  | Pink                           | B              | Signal wire   |
|     |                                | 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>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: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: shielded, 3 m                                 | DOL-2312-G03MMD2 | 2062300  |
|   | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: shielded, 5 m                                 | DOL-2312-G05MMD2 | 2062301  |
|   | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: shielded, 10 m                                | DOL-2312-G10MMD2 | 2062302  |
|   | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: unshielded, 1.5 m                             | DOL-2312-G1M5MD2 | 2062284  |
|   | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: shielded, 20 m                                | DOL-2312-G20MMD2 | 2062303  |

|   | Brief description  | Type                       | Part no.           |
|---|--|----------------------------|--------------------|
|    | Head A: female connector, M23, 12-pin, straight<br>Head B: Flying leads<br>Cable: shielded, 30 m   | DOL-2312-G30MMD2           | 2062304            |
|   | 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<br>DOS-2312-G02 | 6027538<br>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 / 6 mm, maximum shaft offset: radial $\pm$ 0.25 mm, axial $\pm$ 0.4 mm, angular $\pm$ 4°; max. speed 10,000 rpm, -30 °C to +120 °C, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub   | KUP-0606-B                 | 5312981            |
|    | Cross-slotted coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial $\pm$ 0.3 mm, axial $\pm$ 0.2 mm, angle $\pm$ 3°; max. speed 10,000 rpm, -10° to +80 °C, max. torque 80 Ncm; material: fiber-glass reinforced polyamide, aluminum hub   | KUP-0606-S                 | 2056406            |
|   | Bar coupling, shaft diameter 6 mm / 8 mm, maximum shaft offset radial $\pm$ 0.3 mm, axial $\pm$ 0.2 mm, angle $\pm$ 3°, max. speed 10,000 rpm, torsion spring rigidity 38 Nm/wheel; material: fiber-glass reinforced polyamide, aluminum hub   | KUP-0608-S                 | 5314179            |
|    | Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial $\pm$ 0.25 mm, axial $\pm$ 0.4 mm, angular $\pm$ 4°; max. speed 10,000 rpm, -30 °C to +120 °C, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub  | KUP-0610-B                 | 5312982            |
|   | Double loop coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radially $\pm$ 2,5 mm, axially $\pm$ 3 mm, angle $\pm$ 10 degrees; max. speed 3.000 rpm, -30 to +80 degrees Celsius, torsional spring stiffness of 25 Nm/rad   | KUP-0610-D                 | 5326697            |
|  | Spring washer coupling, shaft diameter 6 mm / 10 mm, Maximum shaft offset: radial $\pm$ 0.3 mm, axial $\pm$ 0.4 mm, angular $\pm$ 2.5°; max. speed 12,000 rpm, -10° to +80 °C, max. torque 60 Ncm; material: aluminum flange, glass fiber-reinforced polyamide membrane and hardened steel coupling pin  | KUP-0610-F                 | 5312985            |
|  | Claw coupling, shaft diameter 6 mm / 10 mm, damping element 80 shore blue, maximum shaft offset: radial $\pm$ 0.22 mm, axial $\pm$ 1 mm angular $\pm$ 1.3°, max. speed 19,000 rpm, angle of twist max. 10°, -30 °C to +80 °C, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane | KUP-0610-J                 | 2127056            |
|  | Bar coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radial $\pm$ 0,3 mm, axial $\pm$ 0,3 mm, angular $\pm$ 3°; max. speed 10.000 rpm, -10° to +80 °C, max. torque: 80 Ncm, material: fiber-glass reinforced polyamide, aluminum hub  | KUP-0610-S                 | 2056407            |

## SICK AT A GLANCE

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

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