



# AFM60E-TFKA004096

AFS/AFM60 SSI

**ABSOLUTE ENCODERS**

**SICK**  
Sensor Intelligence.



## Ordering information

| Type              | part no. |
|-------------------|----------|
| AFM60E-TFKA004096 | 1067840  |

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

Illustration may differ



## Detailed technical data

## Safety-related parameters

|                                                          |                                          |
|----------------------------------------------------------|------------------------------------------|
| <b>MTTF<sub>D</sub> (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.

## Performance

|                                                                                 |                                 |
|---------------------------------------------------------------------------------|---------------------------------|
| <b>Number of steps per revolution (max. resolution)</b>                         | 4,096 (12 bit)                  |
| <b>Number of revolutions</b>                                                    | 4,096 (12 bit)                  |
| <b>Max. resolution (number of steps per revolution x number of revolutions)</b> | 12 bit x 12 bit (4,096 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 + Sin/Cos                                      |
| <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) |

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

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

|                                                     |                                          |
|-----------------------------------------------------|------------------------------------------|
| <b>CW/CCW (counting sequence when turning)</b>      | L-active (L = 0 - 1,5 V, H = 2,0 - Us V) |
| <b>Sine/cosine periods per revolution</b>           | 1,024                                    |
| <b>Output frequency</b>                             | ≤ 200 kHz                                |
| <b>Load resistance</b>                              | ≥ 120 Ω                                  |
| <b>Signal before differential generation</b>        | 0.5 V <sub>pp</sub> , ± 20 %, 120 Ω      |
| <b>Signal offset before differential generation</b> | 2.5 V ± 10 %                             |
| <b>Signal after differential generation</b>         | 1 V <sub>pp</sub> , ± 20 %               |

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

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

## Electronics

|                                    |                                     |
|------------------------------------|-------------------------------------|
| <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> | ✓                                   |

## Mechanics

|                                       |                                         |
|---------------------------------------|-----------------------------------------|
| <b>Mechanical design</b>              | Through hollow shaft                    |
| <b>Shaft diameter</b>                 | 1/2"                                    |
| <b>Characteristics of the shaft</b>   | Front clamp                             |
| <b>Weight</b>                         | 0.2 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>                | < 0.8 Ncm (+20 °C)                      |
| <b>Operating torque</b>               | < 0.6 Ncm (+20 °C)                      |
| <b>Permissible movement static</b>    | ± 0.3 mm (radial)<br>± 0.5 mm (axial)   |
| <b>Permissible movement dynamic</b>   | ± 0.1 mm (radial)<br>± 0.2 mm (axial)   |
| <b>Operating speed</b>                | ≤ 9,000 min <sup>-1</sup> <sup>2)</sup> |
| <b>Moment of inertia of the rotor</b> | 40 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)                                            |

<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.

|                                    |                                         |
|------------------------------------|-----------------------------------------|
| <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.

## Certificates

|                                                                              |   |
|------------------------------------------------------------------------------|---|
| <b>EU declaration of conformity</b>                                          | ✓ |
| <b>UK declaration of conformity</b>                                          | ✓ |
| <b>ACMA declaration of conformity</b>                                        | ✓ |
| <b>Moroccan declaration of conformity</b>                                    | ✓ |
| <b>China RoHS</b>                                                            | ✓ |
| <b>cULus certificate</b>                                                     | ✓ |
| <b>Information according to Art. 3 of Data Act (Regulation EU 2023/2854)</b> | ✓ |

## 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

## Anschlussbelegung M23 male connector, 12-pin and cable, 12-wire, SSI/Gray + SIN/COS



view of M23 male device connector on encoder

| PIN | Wire colors (cable connection) | SignalIncremental | 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                          | - SIN             | Signal wire                       |
| 9   | Orange-black                   | CW/CCW (V/R)      | Sequence in direction of rotation |

| PIN | Wire colors (cable connection) | SignalIncremental | Explanation                                                                       |
|-----|--------------------------------|-------------------|-----------------------------------------------------------------------------------|
| 10  | Green                          | - COS             | Signal wire                                                                       |
| 11  | Gray                           | + COS             | Signal wire                                                                       |
| 12  | Pink                           | + SIN             | Signal wire                                                                       |
| -   | -                              | Shielding         | 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. |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|
| connectors and cables                                                               |                                                                                                                                                                                                                                                                                                                           |                  |          |
|    | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, angled, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE®, SSI, Incremental</li> <li>• <b>Description:</b> HIPERFACE®, shieldedSSIIncremental</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>   | DOS-2312-W01     | 2072580  |
|    | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE®, SSI, Incremental</li> <li>• <b>Description:</b> HIPERFACE®, shieldedSSIIncremental</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul> | DOS-2312-G02     | 2077057  |
|    | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE®, SSI, Incremental</li> <li>• <b>Description:</b> HIPERFACE®, shieldedSSIIncremental</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul> | DOS-2312-G       | 6027538  |
|    | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Cable:</b> 3 m, 12-wire</li> <li>• <b>Description:</b> Shielded</li> </ul>                                                           | DOL-2312-G03MMD2 | 2062300  |
|    | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Cable:</b> 5 m, 12-wire</li> <li>• <b>Description:</b> Shielded</li> </ul>                                                           | DOL-2312-G05MMD2 | 2062301  |
|    | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Cable:</b> 1.5 m, 12-wire</li> <li>• <b>Description:</b> Unshielded</li> </ul>                                                       | DOL-2312-G1M5MD2 | 2062284  |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Cable:</b> 10 m, 12-wire</li> <li>• <b>Description:</b> Shielded</li> </ul>                                                          | DOL-2312-G10MMD2 | 2062302  |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Cable:</b> 20 m, 12-wire</li> <li>• <b>Description:</b> Shielded</li> </ul>                                                          | DOL-2312-G20MMD2 | 2062303  |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 12-pin, straight</li> <li>• <b>Connection type head B:</b> Flying leads</li> <li>• <b>Cable:</b> 30 m, 12-wire</li> <li>• <b>Description:</b> Shielded</li> </ul>                                                          | DOL-2312-G30MMD2 | 2062304  |
|  | <ul style="list-style-type: none"> <li>• <b>Connection type head A:</b> Female connector, M23, 9-pin, straight, A-coded</li> <li>• <b>Signal type:</b> HIPERFACE®, SSI, Incremental</li> <li>• <b>Description:</b> HIPERFACE®, shieldedSSIIncremental</li> <li>• <b>Connection systems:</b> Solder connection</li> </ul>  | DOS-2309-G       | 6028533  |

## 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.

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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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