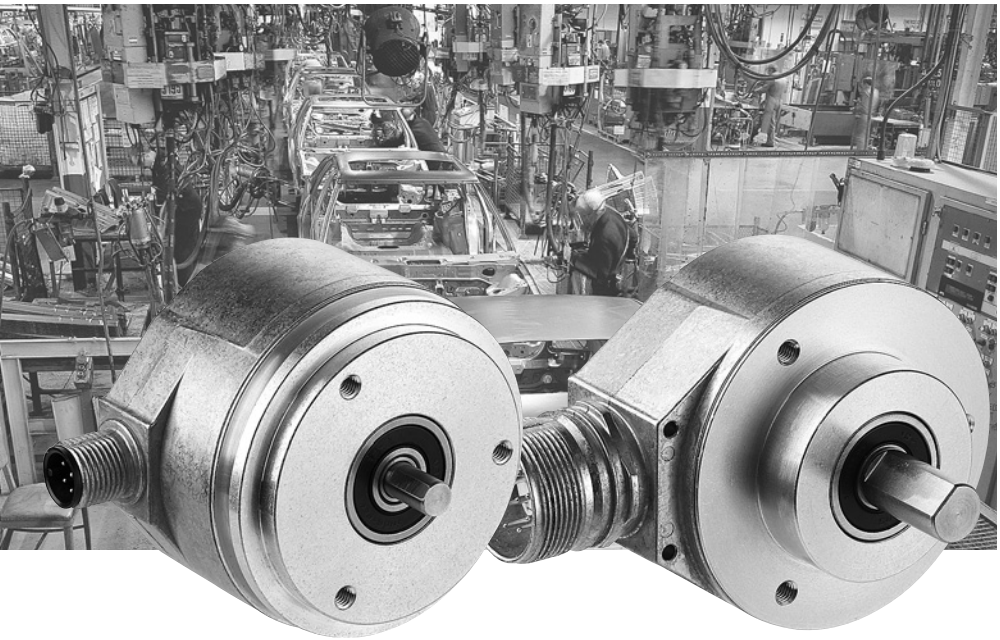
# AFS60: Absolute Encoders Singleturn, SSI
# AFM60: Absolute Encoders Multiturn SSI, SSI + Incremental and SSI + Sin/Cos



**Resolution up to 18 bits**
**Absolute Encoders Singleturn**

**Resolution up to 30 bits**
**Absolute Encoders Multiturn**

**Number of lines 1 up to 65,536**
**Incremental Encoders**

With a 30-bit resolution and an extremely robust construction, the new AFM60 Absolute Encoders Multiturn sets a new benchmark. Even its small brother, the AFS60 Absolute Encoders Singleturn, is impressive, with its high resolution of 18 bits. Consequently, both new product ranges are particularly suitable for harsh operating conditions in all industrial applications where high levels of accuracy and reliability are paramount.

With a maximum singleturn resolution of 18 bits, the AFM60 is among the highest performing encoders in its market segment.

With the addition of a 12-bit multiturn resolution, the encoder reaches a class leading resolution totalling 30 bits.

Thanks to the 30 mm separation of the shaft bearings, the AFM/AFS60 product range offers users a substantially more robust solution than encoders with more conventional bearing arrangements. Even at maximum operating speeds, the increased bearing separation leads to exceptionally smooth operation as well as optimum runout. Despite the large bearing separation, the AFS/AFM60 product ranges have an extremely compact construction enabling use in applications with very limited space.

Both the AFM60 and the AFS60 can be programmed using the same programming tool as used with the DFS60 series of incremental encoders from SICK. For the very first time, incremental, singleturn Absolute and multiturn Absolute Encoders can be parametrised using just one universal programming tool.

Product options:
Face mount flange and servo flange, blind hollow shaft and throug hollow shaft
M12 or M23 Connector outlet
1.5 m, 3 m or 5 m cable outlet, radial or axial Resolution: Singleturn 18 bits max. Multiturn 12 bits

SICK
Sensor Intelligence.

**Resolution up to 18 bits**

**Absolute Encoders Singleturn**

**Resolution up 30 bits**

**Absolute Encoders Multiturn**

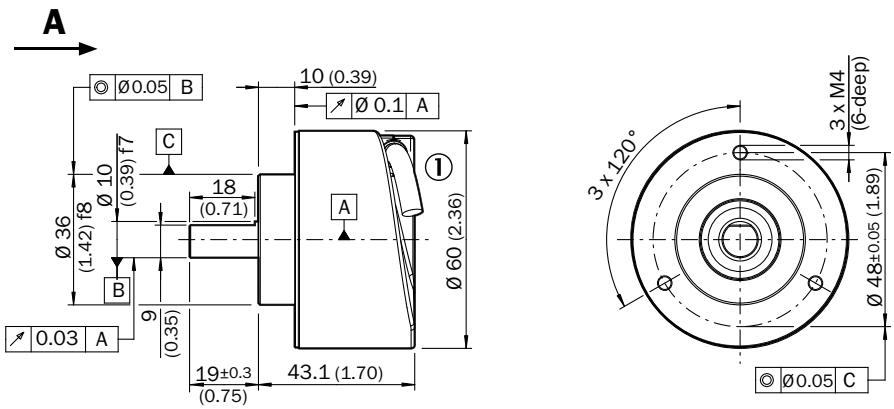
**Number of lines 1 up to 65,536**

**Incremental Encoders**

- Electrical interface SSI, SSI + Incremental or SSI + Sin/Cos
- Resolution, number of incremental lines, TTL- or HTL-signal and offset programmable
- Connector or cable outlet

Product may differ from illustration

## Dimensional drawing face mount flange, cable outlet

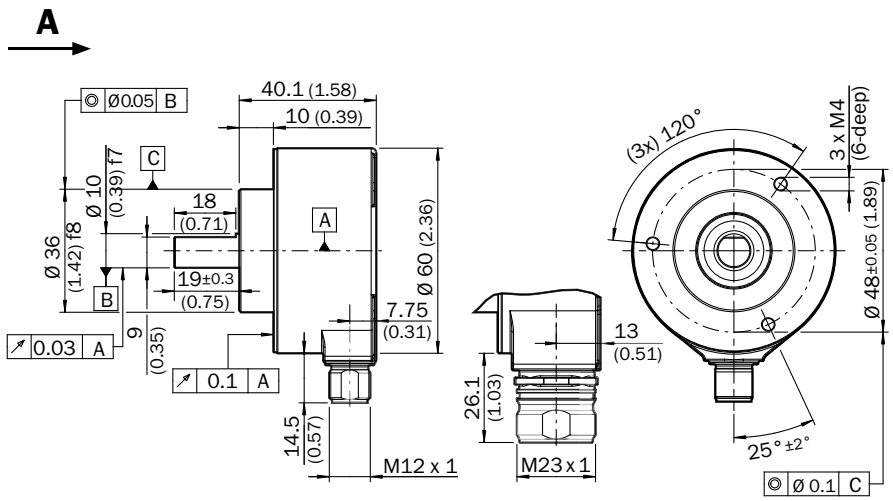



All dimensions in mm (inch)

General tolerances according to DIN ISO 2768-mk

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

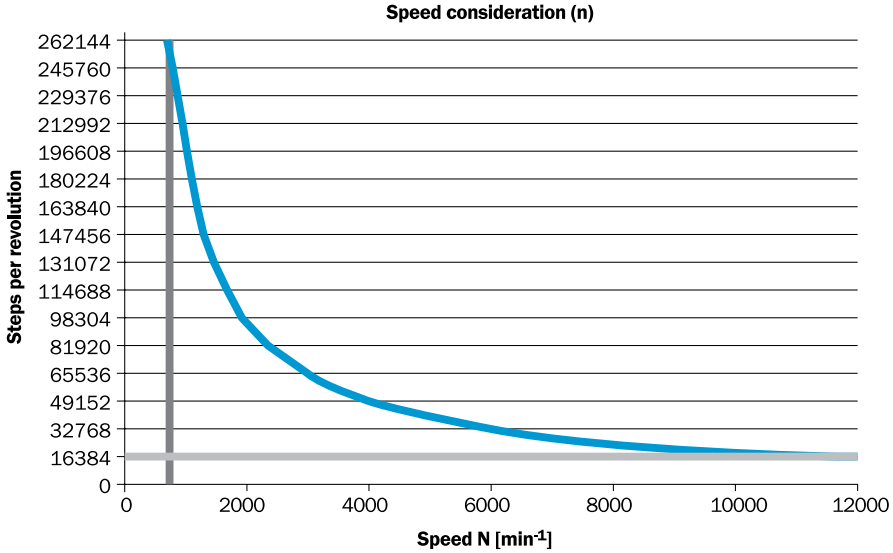
## Dimensional drawing face mount flange, connector outlet M12 and M23




All dimensions in mm (inch)

General tolerances according to DIN ISO 2768-mk

## Maximum speed consideration AFS60/AFM6




**Accessories**

Connection systems (page 29)
Mounting systems (page 31)
Programming Tool (page 27)

**Pin allocation (page 26)**



2011-09
Subject to change without notice

| Technical data to DIN 32878 | AFS60/AFM60 face mount flange | E | B | A |
|---|---|---|---|---|
| **Mechanical data** | | | | |
| **Shaft diameter** | 10 x 19 mm | | | |
| **Mass** [1] | 0.26 kg | | | |
| **Moment of inertia to the rotor** | 6.2 gcm$^2$ | | | |
| **Operating speed** [2] | 9,000 min$^{-1}$ | | | |
| **Angular acceleration max.** | 5 x 10$^5$ rad/s$^2$ | | | |
| **Operating torque at 20 °C** | 0.3 Ncm | | | |
| **Starting torque at 20 °C** | 0.5 Ncm | | | |
| **Permissible shaft movement** | Radial | 80 N | 80 N | 80 N |
| | Axial | 40 N | 40 N | 40 N |
| **Bearing lifetime** | 3 x 10$^9$ revolutions | | | |
| **Resistance** | To shocks [3] | 50 g/6 ms | 70 g/6 ms | 60 g/6 ms |
| | To vibration [4] | 20 g/10 ... 2,000 Hz | 30 g/10 ... 2,000 Hz | 20 g/10 ... 2,000 Hz |
| **Electrical data** | | | | |
| **Code sequence adjustable** | CW/CCW | | | |
| **Error limits** | | ± 0.2° | ± 0.05° | ± 0.03° |
| **Repeatability** | 0.002° | | | |
| **Position sample time** | < 1 µs | | | |
| **EMC** [5] | To EN 61000-6-2 and EN 61000-6-3 | | | |
| **Operating voltage** | 4.5 ... 32 V | | | |
| **Reverse voltage protection** | | yes | yes | yes |
| **Power consumption, no load** | 0.5 W | | | |
| **Initialisation time** [6] | 50 ms | | | |
| **SSI interface** | | | | |
| Code type | Gray | | | |
| Measuring step | 360°/number of lines | 0.09° | 0.01° | 0.0014° |
| Number of steps per revolution max. | Singleturn and Multiturn (see drawing on page 2) | 4096 | 32768 | 262144 |
| Number of revolutions | 4096 Multiturn (AFM60) | | | |
| Measuring step deviation | Number of lines per revolution 1 ... 399 | ± 0.2° | ± 0.08° | ± 0.04° |
| | Number of lines per revolution 400 ... 40000 | ± 0.2° | ± 0.01° | ± 0.008° |
| | Number of lines per revolution > 40000 | | | ± 0.002° |
| Clock +, Clock –, Data +, Data – | SSI clock frequency 2 MHz; or min. LOW level (Clock +): 500 ns | 1 MHz | 2 MHz | 2 MHz |
| SET (electronic adjustment) | H-active (L = 0 - 3 V; H = 4 - $U_S$ V) | | | |
| CW/$\overline{\text{CCW}}$ (counting sequence when turning) | L-active (L = 0 - 1.5 V; H = 2.0 - $U_S$ V) | | | |
| **Incremental interface TTL/HTL/programmable (AFM60 SSI + Incremental)** | | | | |
| Number of lines per revolution | 1/4 of number of SSI steps per revolution | | | |
| Measuring step | 90° electric/number of lines | | | |
| Interface signals A, $\overline{\text{A}}$, B, $\overline{\text{B}}$ | Digital differential | | | |
| Max. output frequency | | 300 kHz | 600 kHz | 820 kHz |
| Load current | 30 mA | | | |
| **Analog interface Sin/Cos (AFM60 SSI + Sin/Cos)** | | | | |
| Sinus 0.5 $V_{PP}$ | 1,024 | | | |
| Max. output frequency | 200 kHz | | | |
| Load resistance | Min. 120 Ω | | | |
| Interface signals Sin +, Sin –, Cos +, Cos – | Analog, differential | | | |
| Signal before differential generation at load 120 Ω | 0.5 $V_{PP}$ ± 20 % | | | |
| Signal offset | 2.5 V ± 10 % | | | |
| **Environmental data** | | | | |
| **Working temperature range** | | 0 ... +85 °C | –30 ... +100 °C | –30 ... +100 °C |
| **Storage temperature range (without package)** | | –40 ... +100 °C | –40 ... +100 °C | –40 ... +100 °C |
| **Permissible relative humidity** [7] | 90 % | | | |
| **Protection class to IEC 60529** | Shaft side | IP 65 | IP 65 | IP 65 |
| | Housing side connector outlet [8] | IP 67 | IP 67 | IP 67 |
| | Housing side cable outlet | IP 67 | IP 67 | IP 67 |

1) Based on encoders with a connector outlet
2) Self-warming 3.3 k/1,000 min$^{-1}$, when applying, note working temperature range
3) To EN 60068-2-27
4) To EN 60068-2-6
5) The EMC according to the standards quoted is achieved if screened cables are used.
6) Valid positional data can be read once this time has elapsed
7) Condensation of the optical scanning not permitted
8) With mating connector fitted

## Order information

### AFS60 Absolute Encoders Singleturn, face mount flange

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **S** | | | | | | | | | |

| **Type** (cp. technical data page 3) |
|---|
| E |
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Solid shaft, 10 x 19 mm | = **4** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| **Resolution** |
|---|
| Steps per rev. |

Selection depending on the type, see below.

### Type E – Number of lines per revolution

| | | |
|---|---|---|
| 000256 = 8 bits | 001024 = 10 bits | 004096 = 12 bits |
| 000512 = 9 bits | 002048 = 11 bits | |

### Type B – Number of lines per revolution

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | Others on request |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | |
| 001024 = 10 bits | 008192 = 13 bits | | |

### Type A – Number of lines per revolution

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | 131072 = 17 bits |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | 262144 = 18 bits |
| 001024 = 10 bits | 008192 = 13 bits | 065536 = 16 bits | Others on request |

### Order example: AFS60 Absolute Encoders Singleturn, type E, solid shaft 10 x 19 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | **E** | **–** | **S** | **4** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

## Order information

### AFS60 Absolute Encoders Singleturn, face mount flange, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **S** | | | | | | | | | |

| **Type** (cp. technical data page 3) |
|---|
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Solid shaft, 10 x 19 mm | = **4** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **P *** |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| **Resolution *** |
|---|
| Steps per rev. |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Order information programmable version**
**AFS60 Absolute Encoders Singleturn**
**Type B, face mount flange, solid shaft 10 x 19 mm**

| Model name | Part no. |
|---|---|
| AFS60B-S4PA032768 | 1037483 |
| AFS60B-S4PC032768 | 1037484 |
| AFS60B-S4PK032768 | 1037485 |
| AFS60B-S4PL032768 | 1037486 |
| AFS60B-S4PM032768 | 1037487 |

**Order information programmable version**
**AFS60 Absolute Encoders Singleturn**
**Type A, face mount flange, solid shaft 10 x 19 mm**

| Model name | Part no. |
|---|---|
| AFS60A-S4PA262144 | 1037488 |
| AFS60A-S4PC262144 | 1037489 |
| AFS60A-S4PK262144 | 1037490 |
| AFS60A-S4PL262144 | 1037491 |
| AFS60A-S4PM262144 | 1037492 |

## Order information

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray, face mount flange

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

| Type (cp. technical data page 3) |
|---|
| E |
| B |
| A |

| Mechanical interface | |
|---|---|
| Solid shaft, 10 x 19 mm | = **4** |

| Electrical interface | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

| Connection type | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| Resolution |
|---|
| Steps per rev. |

Selection depending on the type, see below.

**Type E – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 001024 = 10 Bit | 004096 = 12 Bit |
| 000512 = 9 Bit | 002048 = 11 Bit | |

**Type B – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | |

**Type A – Number of lines per revolution x 4096 (12 bits)**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit | 131072 = 17 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit | 262144 = 18 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | 065536 = 16 Bit | |

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, face mount flange

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

| Type (cp. technical data page 3) |
|---|
| E |
| B |
| A |

| Mechanical interface | |
|---|---|
| Solid shaft, 10 x 19 mm | = **4** |

| Electrical interface | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, HTL | = **L** |
| 4.5 ... 32 V, SSI/Gray + Incremental, TTL | = **T** |
| 4.5 ... 32 V, SSI/Gray + Sin/Cos, 1,024 periods | = **K** |

| Connection type | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

| Resolution |
|---|
| Steps per rev. |

Selection depending on the type, see below.

**Typ E – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 001024 = 10 Bit (256) | 004096 = 12 Bit (1024) |
| 000512 = 9 Bit (128) | 002048 = 11 Bit (512) | |

**Typ B – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | |

**Typ A – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) | 131072 = 17 Bit (32768) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) | 262144 = 18 Bit (65536) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | 065536 = 16 Bit (16384) | |

**Order example: AFM60 Absolute Encoders Multiturn, type E, solid shaft 10 x 19 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits) x number of revolutions (12 bits)**

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | **E** | **–** | **S** | **4** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

## Order information

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray, face mount flange, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

| Type (cp. technical data page 3) |
|---|
| B |
| A |

| Mechanical interface | |
|---|---|
| Solid shaft, 10 x 19 mm | = **4** |

| Electrical interface | |
|---|---|
| 4.5 ... 32 V, SSI/Gray, programmable | = **P** * |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| Connection type | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| Resolution * |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type B, face mount flange, solid shaft 10 x 19 mm**

| Model name | Part no. |
|---|---|
| AFM60B-S4PA032768 | 1037503 |
| AFM60B-S4PC032768 | 1037504 |
| AFM60B-S4PK032768 | 1037505 |
| AFM60B-S4PL032768 | 1037506 |
| AFM60B-S4PM032768 | 1037507 |

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type A, face mount flange, solid shaft 10 x 19 mm**

| Model name | Part no. |
|---|---|
| AFM60A-S4PA262144 | 1037508 |
| AFM60A-S4PC262144 | 1037509 |
| AFM60A-S4PK262144 | 1037510 |
| AFM60A-S4PL262144 | 1037511 |
| AFM60A-S4PM262144 | 1037512 |

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, face mount flange, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

| Type (cp. technical data page 3) |
|---|
| B |
| A |

| Mechanical interface | |
|---|---|
| Solid shaft, 10 x 19 mm | = **4** |

| Electrical interface | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, programmable | = **R** * |
| 4.5 ... 32 V, SSI/Gray programmable + Sin/Cos, 1,024 periods | = **S** * |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

| Connection type | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

| Resolution * |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type B and A, face mount flange, solid shaft 10 x 19 mm, SSI/Gray + Incremental**

| Model name | Part no. |
|---|---|
| AFM60B-S4RA032768 | 1052833 |
| AFM60A-S4RA262144 | 1052624 |

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type B and A, face mount flange, solid shaft 10 x 19 mm, SSI/Gray + Sin/Cos**

| Model name | Part no. |
|---|---|
| AFM60B-S4SA032768 | 1054222 |
| AFM60A-S4SA262144 | 1054221 |

**Resolution up to 18 bits**

**Absolute Encoders Singleturn**

**Resolution up 30 bits**

**Absolute Encoders Multiturn**

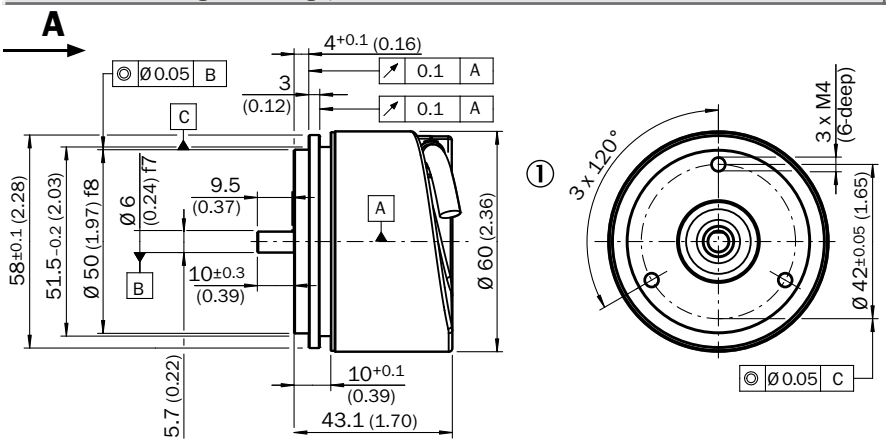
**Number of lines 1 up to 65,536**

**Incremental Encoders**

- Electrical interface SSI, SSI + Incremental or SSI + Sin/Cos
- Resolution, number of incremental lines, TTL- or HTL-signal and offset programmable
- Connector or cable outlet

Product may differ from illustration

**Dimensional drawing servo flange, cable outlet**

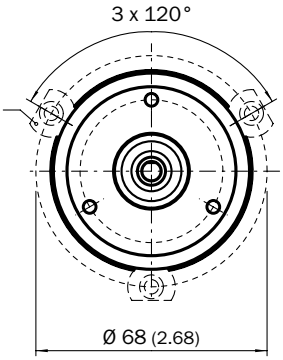



General tolerances according to DIN ISO2768 -mk

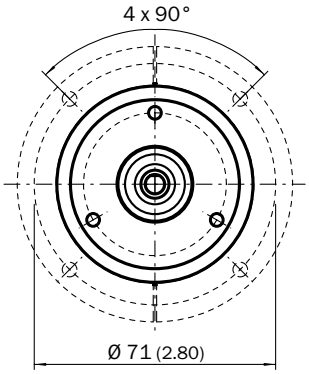
① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

All dimensions in mm (inch)

Proposed customer fitting for servo clamps small, part no. 2029166

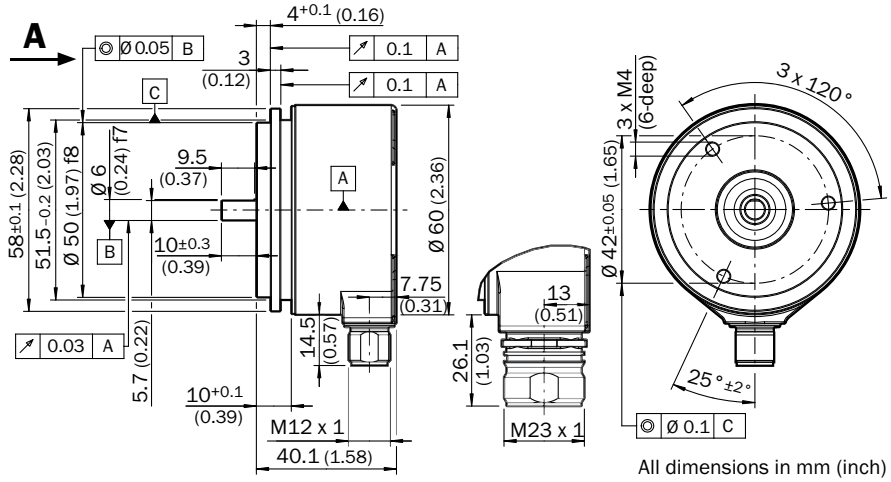



Proposed customer fitting for servo clamps half ring, part no. 2029165




All dimensions in mm (inch)

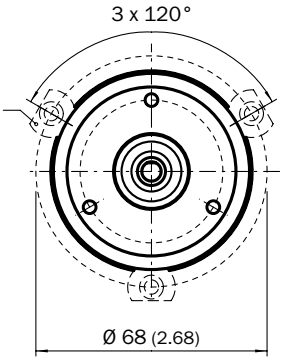
**Dimensional drawing servo flange, connector outlet M12 and M23**



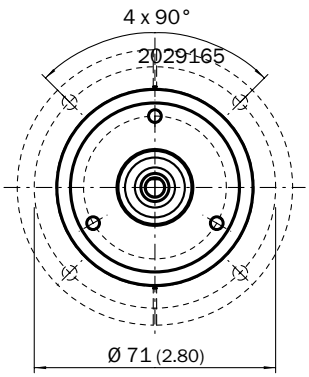

All dimensions in mm (inch)

General tolerances according to DIN ISO2768 -mk

Proposed customer fitting for servo clamps small, part no. 2029166




Proposed customer fitting for servo clamps half ring, part no. 2029165




All dimensions in mm (inch)

**Accessories**

Connection systems (page 29)
Mounting systems (page 31)
Programming Tool (page 27)

**Pin allocation (page 26)**

| Technical data to DIN 32878 | AFS60/AFM60 servo flange | E | B | A |
|---|---|---|---|---|
| **Mechanical data** | | | | |
| **Shaft diameter** | 6 x 10 mm | | | |
| **Mass** [1] | 0.26 kg | | | |
| **Moment of inertia to the rotor** | 6.2 gcm² | | | |
| **Operating speed** [2] | 9,000 min⁻¹ | | | |
| **Angular acceleration max.** | 5 x 10⁵ rad/s² | | | |
| **Operating torque at 20 °C** | 0.3 Ncm | | | |
| **Starting torque at 20 °C** | 0.5 Ncm | | | |
| **Permissible shaft movement** | Radial | 80 N | 80 N | 80 N |
| | Axial | 40 N | 40 N | 40 N |
| **Bearing lifetime** | 3 x 10⁹ revolutions | | | |
| **Resistance** | To shocks [3] | 50 g/6 ms | 70 g/6 ms | 60 g/6 ms |
| | To vibration [4] | 20 g/10 ... 2,000 Hz | 30 g/10 ... 2,000 Hz | 20 g/10 ... 2,000 Hz |
| **Electrical data** | | | | |
| **Code sequence adjustable** | CW/CCW | | | |
| **Error limits** | | ± 0.2° | ± 0.05° | ± 0.03° |
| **Repeatability** | 0.002° | | | |
| **Position sample time** | < 1 µs | | | |
| **EMC** [5] | To EN 61000-6-2 and EN 61000-6-3 | | | |
| **Operating voltage** | 4.5 ... 32 V | | | |
| **Reverse voltage protection** | | yes | yes | yes |
| **Power consumption, no load** | 0.5 W | | | |
| **Initialisation time** [6] | 50 ms | | | |
| **SSI interface** | | | | |
| Code type | Gray | | | |
| Measuring step | 360°/number of lines | 0.09° | 0.01° | 0.0014° |
| Number of steps per revolution max. | Singleturn and Multiturn (see drawing on page 2) | 4096 | 32768 | 262144 |
| Number of revolutions | 4096 Multiturn (AFM60) | | | |
| Measuring step deviation | Number of lines per revolution 1 ... 399 | ± 0.2° | ± 0.08° | ± 0.04° |
| | Number of lines per revolution 400 ... 40000 | ± 0.2° | ± 0.01° | ± 0.008° |
| | Number of lines per revolution > 40000 | | | ± 0.002° |
| Clock +, Clock –, Data +, Data – | SSI clock frequency 2 MHz; or min. LOW level (Clock +): 500 ns | 1 MHz | 2 MHz | 2 MHz |
| SET (electronic adjustment) | H-active (L = 0 - 3 V; H = 4 - $U_S$ V) | | | |
| CW/$\overline{\text{CCW}}$ (counting sequence when turning) | L-active (L = 0 - 1.5 V; H = 2.0 - $U_S$ V) | | | |
| **Incremental interface TTL/HTL/programmable (AFM60 SSI + Incremental)** | | | | |
| Number of lines per revolution | 1/4 of number of SSI steps per revolution | | | |
| Measuring step | 90° electric/number of lines | | | |
| Interface signals A, $\overline{\text{A}}$, B, $\overline{\text{B}}$ | Digital differential | | | |
| Max. output frequency | | 300 kHz | 600 kHz | 820 kHz |
| Load current | 30 mA | | | |
| **Analog interface Sin/Cos (AFM60 SSI + Sin/Cos)** | | | | |
| Sinus 0.5 $V_{PP}$ | 1,024 | | | |
| Max. output frequency | 200 kHz | | | |
| Load resistance | Min. 120 Ω | | | |
| Interface signals Sin +, Sin –, Cos +, Cos – | Analog, differential | | | |
| Signal before differential generation at load 120 Ω | 0.5 $V_{PP}$ ± 20 % | | | |
| Signal offset | 2.5 V ± 10 % | | | |
| **Environmental data** | | | | |
| **Working temperature range** | | 0 ... +85 °C | –30 ... +100 °C | –30 ... +100 °C |
| **Storage temperature range (without package)** | | –40 ... +100 °C | –40 ... +100 °C | –40 ... +100 °C |
| **Permissible relative humidity** [7] | 90 % | | | |
| **Protection class to IEC 60529** | Shaft side | IP 65 | IP 65 | IP 65 |
| | Housing side connector outlet [8] | IP 67 | IP 67 | IP 67 |
| | Housing side cable outlet | IP 67 | IP 67 | IP 67 |

1) Based on encoders with a connector outlet
2) Self-warming 3.3 k/1,000 min⁻¹, when applying, note working temperature range
3) To EN 60068-2-27
4) To EN 60068-2-6
5) The EMC according to the standards quoted is achieved if screened cables are used.
6) Valid positional data can be read once this time has elapsed
7) Condensation of the optical scanning not permitted
8) With mating connector fitted

## Order information

### AFS60 Absolute Encoders Singleturn, servo flange

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **S** | | | | | | | | | |

**Type** (cp. technical data page 9)

- E
- B
- A

**Mechanical interface**

| | |
|---|---|
| Solid shaft, 6 x 10 mm | = **1** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution**

Steps per rev.

Selection depending on the type, see below.

### Type E – Number of lines per revolution

| | | |
|---|---|---|
| 000256 = 8 bits | 001024 = 10 bits | 004096 = 12 bits |
| 000512 = 9 bits | 002048 = 11 bits | |

### Type B – Number of lines per revolution

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | Others on request |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | |
| 001024 = 10 bits | 008192 = 13 bits | | |

### Type A – Number of lines per revolution

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | 131072 = 17 bits |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | 262144 = 18 bits |
| 001024 = 10 bits | 008192 = 13 bits | 065536 = 16 bits | Others on request |

### Order example: AFS60 Absolute Encoders Singleturn, type E, solid shaft 6 x 10 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | **E** | **–** | **S** | **1** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

## Order information

### AFS60 Absolute Encoders Singleturn, servo flange, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **S** | | | | | | | | | |

**Type** (cp. technical data page 9)

| |
|---|
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Solid shaft, 6 x 10 mm | = **1** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **P *** |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution ***

| |
|---|
| Steps per rev. |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Order information programmable version**
**AFS60 Absolute Encoders Singleturn**
**Type B, servo flange, solid shaft 6 x 10 mm**

| Model name | Part no. |
|---|---|
| AFS60B-S1PA032768 | 1037493 |
| AFS60B-S1PC032768 | 1037494 |
| AFS60B-S1PK032768 | 1037495 |
| AFS60B-S1PL032768 | 1037496 |
| AFS60B-S1PM032768 | 1037497 |

**Order information programmable version**
**AFS60 Absolute Encoders Singleturn**
**Type A, servo flange, solid shaft 6 x 10 mm**

| Model name | Part no. |
|---|---|
| AFS60A-S1PA262144 | 1037498 |
| AFS60A-S1PC262144 | 1037499 |
| AFS60A-S1PK262144 | 1037500 |
| AFS60A-S1PL262144 | 1037501 |
| AFS60A-S1PM262144 | 1037502 |

## Order information

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray, servo flange

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

**Type** (cp. technical data page 9)

| |
|---|
| E |
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Solid shaft, 6 x 10 mm | = **1** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution**

Steps per rev.

Selection depending on the type, see below.

**Type E – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 001024 = 10 Bit | 004096 = 12 Bit |
| 000512 = 9 Bit | 002048 = 11 Bit | |

**Type B – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | |

**Type A – Number of lines per revolution x 4096 (12 bits)**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit | 131072 = 17 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit | 262144 = 18 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | 065536 = 16 Bit | |

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, servo flange

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

**Type** (cp. technical data page 9)

| |
|---|
| E |
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Solid shaft, 6 x 10 mm | = **1** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, HTL | = **L** |
| 4.5 ... 32 V, SSI/Gray + Incremental, TTL | = **T** |
| 4.5 ... 32 V, SSI/Gray + Sin/Cos, 1,024 periods | = **K** |

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

**Resolution**

Steps per rev.

Selection depending on the type, see below.

**Typ E – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 001024 = 10 Bit (256) | 004096 = 12 Bit (1024) |
| 000512 = 9 Bit (128) | 002048 = 11 Bit (512) | |

**Typ B – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | |

**Typ A – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) | 131072 = 17 Bit (32768) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) | 262144 = 18 Bit (65536) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | 065536 = 16 Bit (16384) | |

**Order example: AFM60 Absolute Encoders Multiturn, type E, solid shaft 6 x 10 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits) x number of revolutions (12 bits)**

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | **E** | **–** | **S** | **1** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

## Order information

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray, servo flange, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

**Type** (cp. technical data page 9)

| |
|---|
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Solid shaft, 6 x 10 mm | = **1** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray, programmable | = **P *** |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution ***

| |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type B, servo flange, solid shaft 6 x 10 mm**

| Model name | Part no. |
|---|---|
| AFM60B-S1PA032768 | 1037513 |
| AFM60B-S1PC032768 | 1037514 |
| AFM60B-S1PK032768 | 1037515 |
| AFM60B-S1PL032768 | 1037516 |
| AFM60B-S1PM032768 | 1037517 |

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type A, servo flange, solid shaft 6 x 10 mm**

| Model name | Part no. |
|---|---|
| AFM60A-S1PA262144 | 1037518 |
| AFM60A-S1PC262144 | 1037519 |
| AFM60A-S1PK262144 | 1037520 |
| AFM60A-S1PL262144 | 1037521 |
| AFM60A-S1PM262144 | 1037522 |

### AFM60 Absolute Encoders Multiturn, 4096 revolutions, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, servo flange, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **S** | | | | | | | | | |

**Type** (cp. technical data page 9)

| |
|---|
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Solid shaft, 6 x 10 mm | = **1** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, programmable | = **R *** |
| 4.5 ... 32 V, SSI/Gray programmable + Sin/Cos, 1,024 periods | = **S *** |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

**Resolution ***

| |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type B and A, servo flange, solid shaft 6 x 10 mm, SSI/Gray + Incremental**

| Model name | Part no. |
|---|---|
| AFM60B-S1RA032768 | 1052835 |
| AFM60A-S1RA262144 | 1052837 |

**Order information programmable version**
**AFM60 Absolute Encoders Multiturn, 4096 revolutions,**
**Type B and A, servo flange, solid shaft 6 x 10 mm, SSI/Gray + Sin/Cos**

| Model name | Part no. |
|---|---|
| AFM60B-S1SA032768 | 1054220 |
| AFM60A-S1SA262144 | 1054219 |

**Resolution up to 18 bits**

**Absolute Encoders Singleturn**

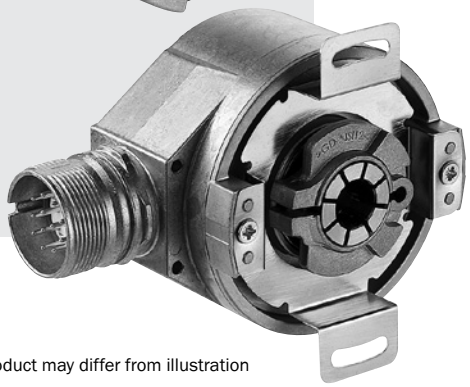
**Resolution up 30 bits**

**Absolute Encoders Multiturn**

**Number of lines 1 up to 65,536**

**Incremental Encoders**

- Electrical interface SSI, SSI + Incremental or SSI + Sin/Cos
- Resolution, number of incremental lines, TTL- or HTL-signal and offset programmable
- Connector or cable outlet



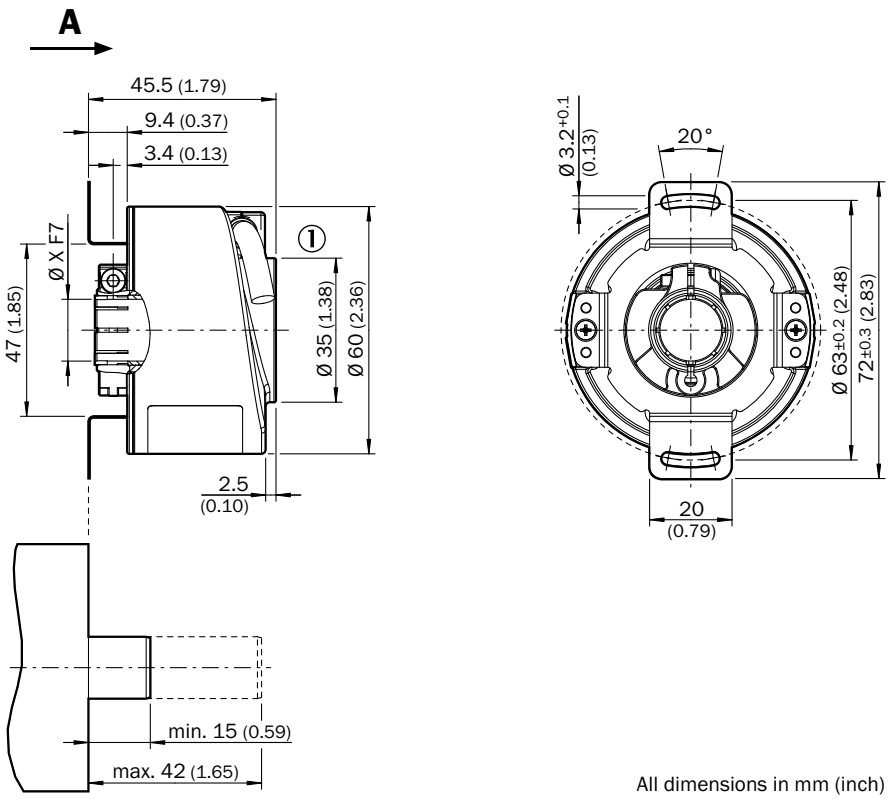
Product may differ from illustration

**Accessories**

Connection systems (page 29)
Mounting systems (page 31)
Programming Tool (page 27)

**Pin allocation (page 26)**

**Dimensional drawing blind hollow shaft, cable outlet**



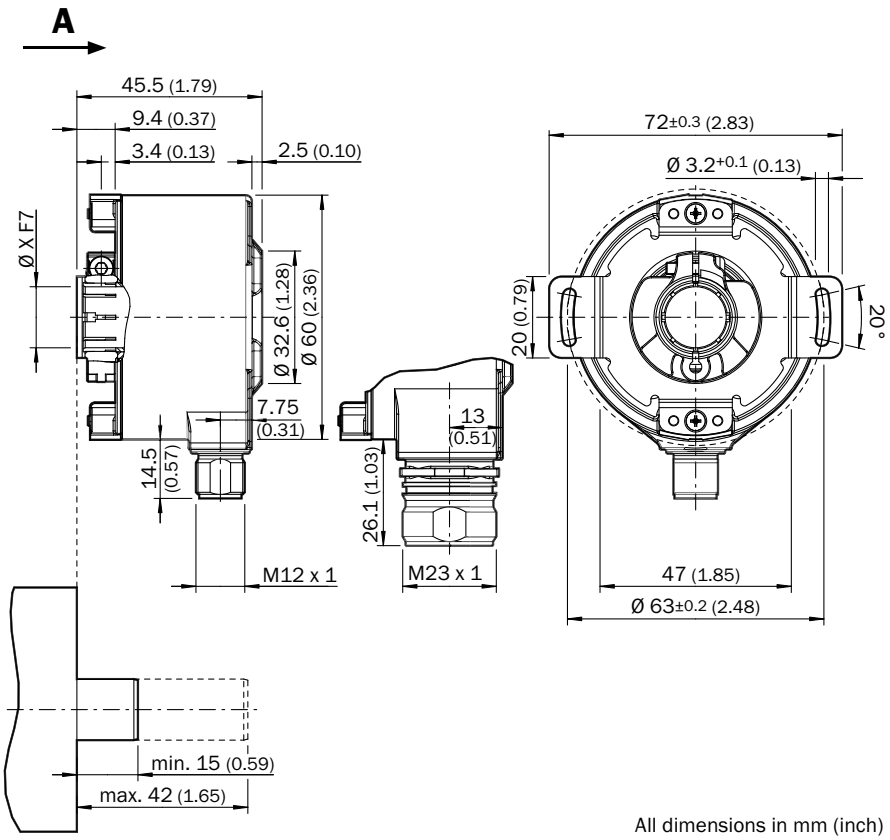

All dimensions in mm (inch)

**Customer-side**

General tolerances according to DIN ISO 2768-mk

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

**Dimensional drawing blind hollow shaft, connector outlet M12 and M23**




All dimensions in mm (inch)

**Customer-side**

General tolerances according to DIN ISO 2768-mk

| Technical data to DIN 32878 | AFS60/AFM60 blind hollow shaft | E | B | A |
|---|---|---|---|---|
| **Mechanical data** | | | | |
| **Shaft diameter** | 8, 10, 12, 14, 15 mm and 3/8", 1/2", 5/8" | | | |
| **Mass** [1] | 0.2 kg | | | |
| **Moment of inertia to the rotor** | 40 gcm² | | | |
| **Operating speed** [2] | 6,000 min⁻¹ | | | |
| **Angular acceleration max.** | 5 x 10⁵ rad/s² | | | |
| **Operating torque at 20 °C** | 0.6 Ncm | | | |
| **Starting torque at 20 °C** | 0.8 Ncm | | | |
| **Permissible movement of the drive element** | | | | |
| Radial | Static/dynamic | ± 0.3 /± 0.1 mm | ± 0.3/± 0.1 mm | ± 0.3/± 0.05 mm |
| Axial | Static/dynamic | ± 0.5/± 0.2 mm | ± 0.5 /± 0.2 mm | ± 0.5 /± 0.01 mm |
| **Bearing lifetime** | 3 x 10⁹ revolutions | | | |
| **Resistance** | To shocks [3] | 50 g/6 ms | 70 g/6 ms | 60 g/6 ms |
| | To vibration [4] | 20 g/10 ... 2,000 Hz | 30 g/10 ... 2,000 Hz | 20 g/10 ... 2,000 Hz |
| **Electrical data** | | | | |
| **Code sequence adjustable** | CW/CCW | | | |
| **Error limits** | | ± 0.3° | ± 0.05° | ± 0.03° |
| **Repeatability** | 0.002° | | | |
| **Position sample time** | < 1 µs | | | |
| **EMC** [5] | To EN 61000-6-2 and EN 61000-6-3 | | | |
| **Operating voltage** | 4.5 ... 32 V | | | |
| **Reverse voltage protection** | | yes | yes | yes |
| **Power consumption, no load** | 0.5 W | | | |
| **Initialisation time** [6] | 50 ms | | | |
| **SSI interface** | | | | |
| Code type | Gray | | | |
| Measuring step | 360°/number of lines | 0.09° | 0.01° | 0.0014° |
| Number of steps per revolution max. | Singleturn and Multiturn (see drawing on page 2) | 4096 | 32768 | 262144 |
| Number of revolutions | 4096 Multiturn (AFM60) | | | |
| Measuring step deviation | Number of lines per revolution 1 ... 399 | ± 0.2° | ± 0.08° | ± 0.04° |
| | Number of lines per revolution 400 ... 40000 | ± 0.2° | ± 0.01° | ± 0.008° |
| | Number of lines per revolution > 40000 | | | ± 0.002° |
| Clock +, Clock –, Data +, Data – | SSI clock frequency 2 MHz; or min. LOW level (Clock +): 500 ns | 1 MHz | 2 MHz | 2 MHz |
| SET (electronic adjustment) | H-active (L = 0 - 3 V; H = 4 - $U_S$ V) | | | |
| CW/$\overline{\text{CCW}}$ (counting sequence when turning) | L-active (L = 0 - 1.5 V; H = 2.0 - $U_S$ V) | | | |
| **Incremental interface TTL/HTL/programmable (AFM60 SSI + Incremental)** | | | | |
| Number of lines per revolution | 1/4 of number of SSI steps per revolution | | | |
| Measuring step | 90° electric/number of lines | | | |
| Interface signals A, $\overline{\text{A}}$, B, $\overline{\text{B}}$ | Digital differential | | | |
| Max. output frequency | | 300 kHz | 600 kHz | 820 kHz |
| Load current | 30 mA | | | |
| **Analog interface Sin/Cos (AFM60 SSI + Sin/Cos)** | | | | |
| Sinus 0.5 $V_{PP}$ | 1,024 | | | |
| Max. output frequency | 200 kHz | | | |
| Load resistance | Min. 120 Ω | | | |
| Interface signals Sin +, Sin –, Cos +, Cos – | Analog, differential | | | |
| Signal before differential generation at load 120 Ω | 0.5 $V_{PP}$ ± 20 % | | | |
| Signal offset | 2.5 V ± 10 % | | | |
| **Environmental data** | | | | |
| **Working temperature range** | | 0 ... +85 °C | –30 ... +100 °C | –30 ... +100 °C |
| **Storage temperature range (without package)** | | –40 ... +100 °C | –40 ... +100 °C | –40 ... +100 °C |
| **Permissible relative humidity** [7] | 90 % | | | |
| **Protection class to IEC 60529** | Shaft side | IP 65 | IP 65 | IP 65 |
| | Housing side connector outlet [8] | IP 67 | IP 67 | IP 67 |
| | Housing side cable outlet | IP 67 | IP 67 | IP 67 |

1) Based on encoders with a connector outlet
2) Self-warming 3.3 k/1,000 min⁻¹, when applying, note working temperature range
3) To EN 60068-2-27
4) To EN 60068-2-6
5) The EMC according to the standards quoted is achieved if screened cables are used.
6) Valid positional data can be read once this time has elapsed
7) Condensation of the optical scanning not permitted
8) With mating connector fitted

## Order information

### AFS60 Absolute Encoders Singleturn, blind hollow shaft

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **B** | | | | | | | | | |

| **Type** (cp. technical data page 15) |
|---|
| E |
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Blind hollow shaft 8 mm | = **B** |
| Blind hollow shaft 3/8" | = **C** |
| Blind hollow shaft 10 mm | = **D** |
| Blind hollow shaft 12 mm | = **E** |
| Blind hollow shaft 1/2" | = **F** |
| Blind hollow shaft 14 mm | = **G** |
| Blind hollow shaft 15 mm | = **H** |
| Blind hollow shaft 5/8" | = **J** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| **Resolution** |
|---|
| Steps per rev. |

Selection depending on the type, see below.

**Type E – Number of lines per revolution**

| | | |
|---|---|---|
| 000256 = 8 bits | 001024 = 10 bits | 004096 = 12 bits |
| 000512 = 9 bits | 002048 = 11 bits | |

**Type B – Number of lines per revolution**

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | Others on request |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | |
| 001024 = 10 bits | 008192 = 13 bits | | |

**Type A – Number of lines per revolution**

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | 131072 = 17 bits |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | 262144 = 18 bits |
| 001024 = 10 bits | 008192 = 13 bits | 065536 = 16 bits | Others on request |

**Order example: AFS60 Absolute Encoders Singleturn, type E, blind hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)**

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | **E** | **–** | **B** | **x** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

## Order information

### AFS60 Absolute Encoders Singleturn, blind hollow shaft, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **B** | | | | | | | | | |

**Type** (cp. technical data page 15)

| |
|---|
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Blind hollow shaft 8 mm | = **B** |
| Blind hollow shaft 3/8" | = **C** |
| Blind hollow shaft 10 mm | = **D** |
| Blind hollow shaft 12 mm | = **E** |
| Blind hollow shaft 1/2" | = **F** |
| Blind hollow shaft 14 mm | = **G** |
| Blind hollow shaft 15 mm | = **H** |
| Blind hollow shaft 5/8" | = **J** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **P *** |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| **Resolution *** |
|---|
| Steps per rev. |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Order information programmable version** |
|---|
| **AFS60 Absolute Encoders Singleturn** |
| **Type B, blind hollow shaft** |
| **Model name** |
| AFS60B-BxPA032768 |
| AFS60B-BxPC032768 |
| AFS60B-BxPK032768 |
| AFS60B-BxPL032768 |
| AFS60B-BxPM032768 |

| **Order information programmable version** |
|---|
| **AFS60 Absolute Encoders Singleturn** |
| **Type A, blind hollow shaft** |
| **Model name** |
| AFS60A-BxPA262144 |
| AFS60A-BxPC262144 |
| AFS60A-BxPK262144 |
| AFS60A-BxPL262144 |
| AFS60A-BxPM262144 |

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

## Order information

### AFM60 Absolute Encoders Multiturn, SSI/Gray, blind hollow shaft

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **B** | | | | | | | | | |

| Type (cp. technical data page 15) |
|---|
| E |
| B |
| A |

| Mechanical interface | |
|---|---|
| Blind hollow shaft 8 mm | = **B** |
| Blind hollow shaft 3/8" | = **C** |
| Blind hollow shaft 10 mm | = **D** |
| Blind hollow shaft 12 mm | = **E** |
| Blind hollow shaft 1/2" | = **F** |
| Blind hollow shaft 14 mm | = **G** |
| Blind hollow shaft 15 mm | = **H** |

| Electrical interface | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

| Connection type | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| Resolution |
|---|
| Steps per rev. |

Selection depending on the type, see below.

**Type E – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 001024 = 10 Bit | 004096 = 12 Bit |
| 000512 = 9 Bit | 002048 = 11 Bit | |

**Type B – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | |

**Type A – Number of lines per revolution x 4096 (12 bits)**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit | 131072 = 17 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit | 262144 = 18 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | 065536 = 16 Bit | |

### AFM60 Absolute Encoders Multiturn, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, blind hollow shaft

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **B** | | | | | | | | | |

| Type (cp. technical data page 15) |
|---|
| E |
| B |
| A |

| Mechanical interface | |
|---|---|
| Blind hollow shaft 8 mm | = **B** |
| Blind hollow shaft 3/8" | = **C** |
| Blind hollow shaft 10 mm | = **D** |
| Blind hollow shaft 12 mm | = **E** |
| Blind hollow shaft 1/2" | = **F** |
| Blind hollow shaft 14 mm | = **G** |
| Blind hollow shaft 15 mm | = **H** |

| Electrical interface | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, HTL | = **L** |
| 4.5 ... 32 V, SSI/Gray + Incremental, TTL | = **T** |
| 4.5 ... 32 V, SSI/Gray + Sin/Cos, 1,024 periods | = **K** |

| Connection type | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

| Resolution |
|---|
| Steps per rev. |

Selection depending on the type, see below.

**Typ E – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 001024 = 10 Bit (256) | 004096 = 12 Bit (1024) |
| 000512 = 9 Bit (128) | 002048 = 11 Bit (512) | |

**Typ B – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | |

**Typ A – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) | 131072 = 17 Bit (32768) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) | 262144 = 18 Bit (65536) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | 065536 = 16 Bit (16384) | |

**Order example: AFM60 Absolute Encoders Multiturn, type E, blind hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)**

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | **E** | **–** | **B** | **x** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

## Order information

### AFM60 Absolute Encoders Multiturn, SSI/Gray, blind hollow shaft, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **B** | | | | | | | | | |

| **Type** (cp. technical data page 15) |
|---|
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Blind hollow shaft 8 mm | = **B** |
| Blind hollow shaft 3/8" | = **C** |
| Blind hollow shaft 10 mm | = **D** |
| Blind hollow shaft 12 mm | = **E** |
| Blind hollow shaft 1/2" | = **F** |
| Blind hollow shaft 14 mm | = **G** |
| Blind hollow shaft 15 mm | = **H** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray, programmable | = **P *** |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| **Resolution *** |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn** |
| **Type B, blind hollow shaft** |
| **Model name** |
| AFM60B-BxPA032768 |
| AFM60B-BxPC032768 |
| AFM60B-BxPK032768 |
| AFM60B-BxPL032768 |
| AFM60B-BxPM032768 |

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn** |
| **Type A, blind hollow shaft** |
| **Model name** |
| AFM60A-BxPA262144 |
| AFM60A-BxPC262144 |
| AFM60A-BxPK262144 |
| AFM60A-BxPL262144 |
| AFM60A-BxPM262144 |

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

### AFM60 Absolute Encoders Multiturn, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, blind hollow shaft, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **B** | | | | | | | | | |

| **Type** (cp. technical data page 15) |
|---|
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Blind hollow shaft 8 mm | = **B** |
| Blind hollow shaft 3/8" | = **C** |
| Blind hollow shaft 10 mm | = **D** |
| Blind hollow shaft 12 mm | = **E** |
| Blind hollow shaft 1/2" | = **F** |
| Blind hollow shaft 14 mm | = **G** |
| Blind hollow shaft 15 mm | = **H** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, programmable | = **R *** |
| 4.5 ... 32 V, SSI/Gray programmable + Sin/Cos, 1,024 periods | = **S *** |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

| **Resolution *** |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn, 4096 revolutions,** |
| **Type B and A, blind hollow shaft, SSI/Gray + Incremental** |
| **Model name** |
| AFM60B-BxRA032768 |
| AFM60A-BxRA262144 |

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn, 4096 revolutions,** |
| **Type B and A, blind hollow shaft, SSI/Gray + Sin/Cos** |
| **Model name** |
| AFM60B-BxSA032768 |
| AFM60A-BxSA262144 |

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

**Resolution up to 18 bits**

**Absolute Encoders Singleturn**

**Resolution up 30 bits**

**Absolute Encoders Multiturn**

**Number of lines 1 up to 65,536**

**Incremental Encoders**

- Electrical interface SSI, SSI + Incremental or SSI + Sin/Cos
- Resolution, number of incremental lines, TTL- or HTL-signal and offset programmable
- Connector or cable outlet

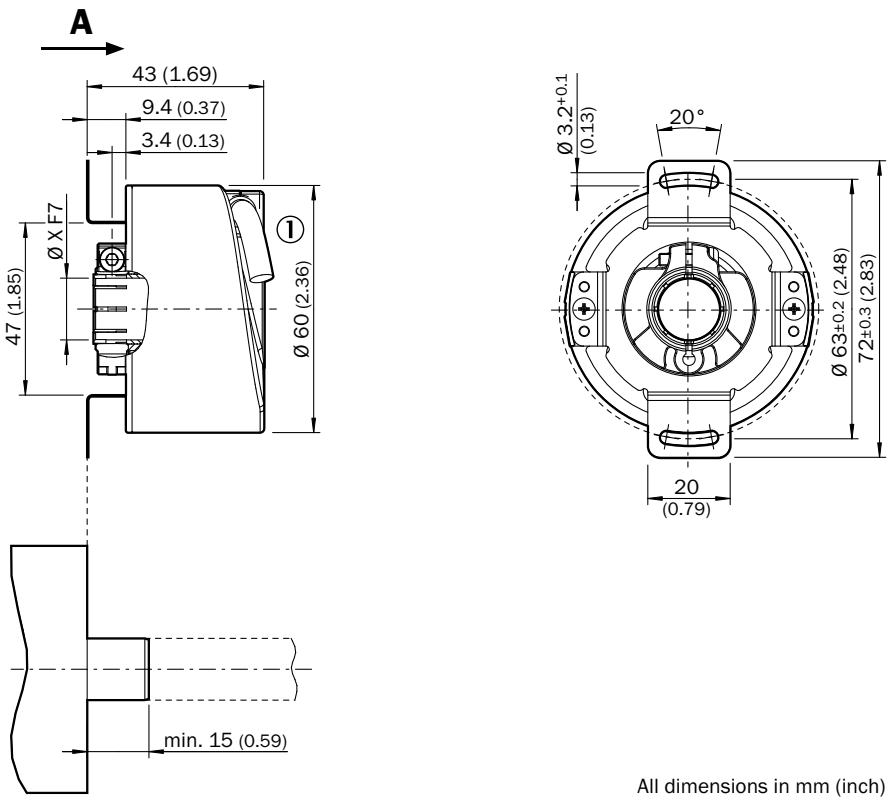
Product may differ from illustration

**Accessories**

Connection systems (page 29)
Mounting systems (page 31)
Programming Tool (page 27)

**Pin allocation (page 26)**

**Dimensional drawing through hollow shaft, cable outlet**



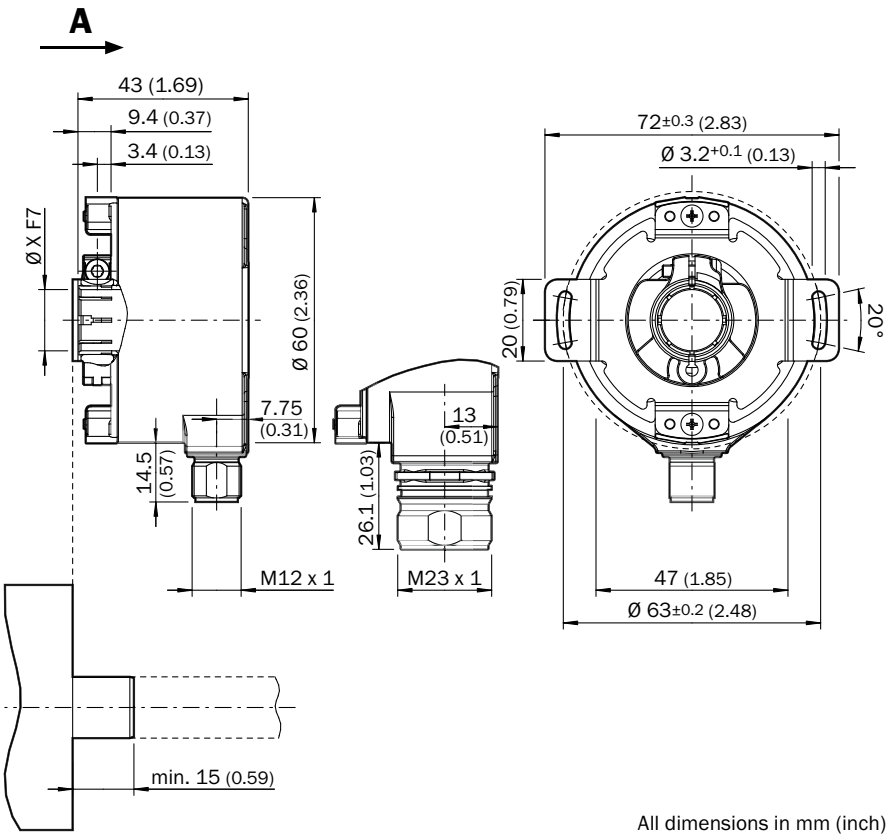

All dimensions in mm (inch)

**Customer-side**

General tolerances according to DIN ISO 2768-mk

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

**Dimensional drawing through hollow shaft, connector outlet M12 and M23**




All dimensions in mm (inch)

**Customer-side**

General tolerances according to DIN ISO 2768-mk

| Technical data to DIN 32878 | AFS60/AFM60 through hollow shaft | E | B | A |
|---|---|---|---|---|
| **Mechanical data** | | | | |
| **Shaft diameter** | 8, 10, 12, 14, 15 mm and 3/8", 1/2", 5/8" | | | |
| **Mass** [1] | 0.2 kg | | | |
| **Moment of inertia to the rotor** | 40 gcm$^2$ | | | |
| **Operating speed** [2] | 9,000 min$^{-1}$ | | | |
| **Angular acceleration max.** | 5 x 10$^5$ rad/s$^2$ | | | |
| **Operating torque at 20 °C** | 0.6 Ncm | | | |
| **Starting torque at 20 °C** | 0.8 Ncm | | | |
| **Permissible movement of the drive element** | | | | |
| Radial | Static/dynamic | ± 0.3 /± 0.1 mm | ± 0.3/± 0.1 mm | ± 0.3/± 0.05 mm |
| Axial | Static/dynamic | ± 0.5/± 0.2 mm | ± 0.5 /± 0.2 mm | ± 0.5 /± 0.01 mm |
| **Bearing lifetime** | 3 x 10$^9$ revolutions | | | |
| **Resistance** | To shocks [3] | 50 g/6 ms | 70 g/6 ms | 60 g/6 ms |
| | To vibration [4] | 20 g/10 ... 2,000 Hz | 30 g/10 ... 2,000 Hz | 20 g/10 ... 2,000 Hz |
| **Electrical data** | | | | |
| **Code sequence adjustable** | CW/CCW | | | |
| **Error limits** | | ± 0.3° | ± 0.05° | ± 0.03° |
| **Repeatability** | 0.002° | | | |
| **Position sample time** | < 1 µs | | | |
| **EMC** [5] | To EN 61000-6-2 and EN 61000-6-3 | | | |
| **Operating voltage** | 4.5 ... 32 V | | | |
| **Reverse voltage protection** | | yes | yes | yes |
| **Power consumption, no load** | 0.5 W | | | |
| **Initialisation time** [6] | 50 ms | | | |
| **SSI interface** | | | | |
| Code type | Gray | | | |
| Measuring step | 360°/number of lines | 0.09° | 0.01° | 0.0014° |
| Number of steps per revolution max. | Singleturn and Multiturn (see drawing on page 2) | 4096 | 32768 | 262144 |
| Number of revolutions | 4096 Multiturn (AFM60) | | | |
| Measuring step deviation | Number of lines per revolution 1 ... 399 | ± 0.2° | ± 0.08° | ± 0.04° |
| | Number of lines per revolution 400 ... 40000 | ± 0.2° | ± 0.01° | ± 0.008° |
| | Number of lines per revolution > 40000 | | | ± 0.002° |
| Clock +, Clock –, Data +, Data – | SSI clock frequency 2 MHz; or min. LOW level (Clock +): 500 ns | 1 MHz | 2 MHz | 2 MHz |
| SET (electronic adjustment) | H-active (L = 0 - 3 V; H = 4 - $U_S$ V) | | | |
| CW/$\overline{\text{CCW}}$ (counting sequence when turning) | L-active (L = 0 - 1.5 V; H = 2.0 - $U_S$ V) | | | |
| **Incremental interface TTL/HTL/programmable (AFM60 SSI + Incremental)** | | | | |
| Number of lines per revolution | 1/4 of number of SSI steps per revolution | | | |
| Measuring step | 90° electric/number of lines | | | |
| Interface signals A, $\overline{\text{A}}$, B, $\overline{\text{B}}$ | Digital differential | | | |
| Max. output frequency | | 300 kHz | 600 kHz | 820 kHz |
| Load current | 30 mA | | | |
| **Analog interface Sin/Cos (AFM60 SSI + Sin/Cos)** | | | | |
| Sinus 0.5 $V_{PP}$ | 1,024 | | | |
| Max. output frequency | 200 kHz | | | |
| Load resistance | Min. 120 Ω | | | |
| Interface signals Sin +, Sin –, Cos +, Cos – | Analog, differential | | | |
| Signal before differential generation at load 120 Ω | 0.5 $V_{PP}$ ± 20 % | | | |
| Signal offset | 2.5 V ± 10 % | | | |
| **Environmental data** | | | | |
| **Working temperature range** | | 0 ... +85 °C | –30 ... +100 °C | –30 ... +100 °C |
| **Storage temperature range (without package)** | | –40 ... +100 °C | –40 ... +100 °C | –40 ... +100 °C |
| **Permissible relative humidity** [7] | 90 % | | | |
| **Protection class to IEC 60529** | Shaft side | IP 65 | IP 65 | IP 65 |
| | Housing side connector outlet [8] | IP 65 | IP 65 | IP 65 |
| | Housing side cable outlet | IP 65 | IP 65 | IP 65 |

1) Based on encoders with a connector outlet
2) Self-warming 3.3 k/1,000 min$^{-1}$, when applying, note working temperature range
3) To EN 60068-2-27
4) To EN 60068-2-6
5) The EMC according to the standards quoted is achieved if screened cables are used.
6) Valid positional data can be read once this time has elapsed
7) Condensation of the optical scanning not permitted
8) With mating connector fitted

## Order information

### AFS60 Absolute Encoders Singleturn, through hollow shaft

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **T** | | | | | | | | | |

**Type** (cp. technical data page 27)

| |
|---|
| E |
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Through hollow shaft 8 mm | = **B** |
| Through hollow shaft 3/8" | = **C** |
| Through hollow shaft 10 mm | = **D** |
| Through hollow shaft 12 mm | = **E** |
| Through hollow shaft 1/2" | = **F** |
| Through hollow shaft 14 mm | = **G** |
| Through hollow shaft 15 mm | = **H** |
| Through hollow shaft 5/8" | = **J** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1)] | = **K** |
| Cable 8-core, universal 3 m [1)] | = **L** |
| Cable 8-core, universal 5 m [1)] | = **M** |

[1)] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution**

Steps per rev.

Selection depending on the type, see below.

**Type E – Number of lines per revolution**

| | | |
|---|---|---|
| 000256 = 8 bits | 001024 = 10 bits | 004096 = 12 bits |
| 000512 = 9 bits | 002048 = 11 bits | |

**Type B – Number of lines per revolution**

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | Others on request |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | |
| 001024 = 10 bits | 008192 = 13 bits | | |

**Type A – Number of lines per revolution**

| | | | |
|---|---|---|---|
| 000256 = 8 bits | 002048 = 11 bits | 016384 = 14 bits | 131072 = 17 bits |
| 000512 = 9 bits | 004096 = 12 bits | 032768 = 15 bits | 262144 = 18 bits |
| 001024 = 10 bits | 008192 = 13 bits | 065536 = 16 bits | Others on request |

**Order example: AFS60 Absolute Encoders Singleturn, type E, through hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)**

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | **E** | **–** | **T** | **x** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

## Order information

### AFS60 Absolute Encoders Singleturn, through hollow shaft, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **S** | **6** | **0** | | **–** | **T** | | | | | | | | | |

**Type** (cp. technical data page 27)

| |
|---|
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Through hollow shaft 8 mm | = **B** |
| Through hollow shaft 3/8" | = **C** |
| Through hollow shaft 10 mm | = **D** |
| Through hollow shaft 12 mm | = **E** |
| Through hollow shaft 1/2" | = **F** |
| Through hollow shaft 14 mm | = **G** |
| Through hollow shaft 15 mm | = **H** |
| Through hollow shaft 5/8" | = **J** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **P *** |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution ***

| |
|---|
| Steps per rev. |

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

**Order information programmable version**
**AFS60 Absolute Encoders Singleturn**
**Type B, through hollow shaft**

| Model name |
|---|
| AFS60B-TxPA032768 |
| AFS60B-TxPC032768 |
| AFS60B-TxPK032768 |
| AFS60B-TxPL032768 |
| AFS60B-TxPM032768 |

**Order information programmable version**
**AFS60 Absolute Encoders Singleturn**
**Type A,through hollow shaft**

| Model name |
|---|
| AFS60A-TxPA262144 |
| AFS60A-TxPC262144 |
| AFS60A-TxPK262144 |
| AFS60A-TxPL262144 |
| AFS60A-TxPM262144 |

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

## Order information

### AFM60 Absolute Encoders Multiturn, SSI/Gray, through hollow shaft

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **T** | | | | | | | | | |

**Type** (cp. technical data page 21)

| |
|---|
| E |
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Through hollow shaft 8 mm | = **B** |
| Through hollow shaft 3/8" | = **C** |
| Through hollow shaft 10 mm | = **D** |
| Through hollow shaft 12 mm | = **E** |
| Through hollow shaft 1/2" | = **F** |
| Through hollow shaft 14 mm | = **G** |
| Through hollow shaft 15 mm | = **H** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray | = **A** |

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

**Resolution**

Steps per rev.

Selection depending on the type, see below.

**Type E – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 001024 = 10 Bit | 004096 = 12 Bit |
| 000512 = 9 Bit | 002048 = 11 Bit | |

**Type B – Number of lines per revolution x 4096 (12 bits)**

| | | |
|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | |

**Type A – Number of lines per revolution x 4096 (12 bits)**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit | 002048 = 11 Bit | 016384 = 14 Bit | 131072 = 17 Bit |
| 000512 = 9 Bit | 004096 = 12 Bit | 032768 = 15 Bit | 262144 = 18 Bit |
| 001024 = 10 Bit | 008192 = 13 Bit | 065536 = 16 Bit | |

### AFM60 Absolute Encoders Multiturn, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, through hollow shaft

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **T** | | | | | | | | | |

**Type** (cp. technical data page 21)

| |
|---|
| E |
| B |
| A |

**Mechanical interface**

| | |
|---|---|
| Through hollow shaft 8 mm | = **B** |
| Through hollow shaft 3/8" | = **C** |
| Through hollow shaft 10 mm | = **D** |
| Through hollow shaft 12 mm | = **E** |
| Through hollow shaft 1/2" | = **F** |
| Through hollow shaft 14 mm | = **G** |
| Through hollow shaft 15 mm | = **H** |

**Electrical interface**

| | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, HTL | = **L** |
| 4.5 ... 32 V, SSI/Gray + Incremental, TTL | = **T** |
| 4.5 ... 32 V, SSI/Gray + Sin/Cos, 1,024 periods | = **K** |

**Connection type**

| | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

**Resolution**

Steps per rev.

Selection depending on the type, see below.

**Typ E – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 001024 = 10 Bit (256) | 004096 = 12 Bit (1024) |
| 000512 = 9 Bit (128) | 002048 = 11 Bit (512) | |

**Typ B – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | |
|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | |

**Typ A – Number of lines per revolution x 4096 (12 Bit), number of incremental lines in brackets**

| | | | |
|---|---|---|---|
| 000256 = 8 Bit (64) | 002048 = 11 Bit (512) | 016384 = 14 Bit (4096) | 131072 = 17 Bit (32768) |
| 000512 = 9 Bit (128) | 004096 = 12 Bit (1024) | 032768 = 15 Bit (8192) | 262144 = 18 Bit (65536) |
| 001024 = 10 Bit (256) | 008192 = 13 Bit (2048) | 065536 = 16 Bit (16384) | |

**Order example: AFM60 Absolute Encoders Multiturn, type E, through hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)**

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | **E** | **–** | **T** | **x** | **A** | **C** | **0** | **0** | **1** | **0** | **2** | **4** |

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

## Order information

### AFM60 Absolute Encoders Multiturn, SSI/Gray, through hollow shaft, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **T** | | | | | | | | | |

| **Type** (cp. technical data page 21) |
|---|
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Through hollow shaft 8 mm | = **B** |
| Through hollow shaft 3/8" | = **C** |
| Through hollow shaft 10 mm | = **D** |
| Through hollow shaft 12 mm | = **E** |
| Through hollow shaft 1/2" | = **F** |
| Through hollow shaft 14 mm | = **G** |
| Through hollow shaft 15 mm | = **H** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray, programmable | = **P *** |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |
| Connector M12, 8-pin, radial | = **C** |
| Cable 8-core, universal 1.5 m [1] | = **K** |
| Cable 8-core, universal 3 m [1] | = **L** |
| Cable 8-core, universal 5 m [1] | = **M** |

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

| **Resolution *** |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn** |
| **Type B, through hollow shaft** |
| **Model name** |
| AFM60B-TxPA032768 |
| AFM60B-TxPC032768 |
| AFM60B-TxPK032768 |
| AFM60B-TxPL032768 |
| AFM60B-TxPM032768 |

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn** |
| **Type A,through hollow shaft** |
| **Model name** |
| AFM60A-TxPA262144 |
| AFM60A-TxPC262144 |
| AFM60A-TxPK262144 |
| AFM60A-TxPL262144 |
| AFM60A-TxPM262144 |

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

### AFM60 Absolute Encoders Multiturn, SSI/Gray + Incremental, SSI/Gray + Sin/Cos, through hollow shaft, programmable version

| Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Point 7 | Point 8 | Point 9 | Point 10 | Point 11 | Point 12 | Point 13 | Point 14 | Point 15 | Point 16 | Point 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **F** | **M** | **6** | **0** | | **–** | **T** | | | | | | | | | |

| **Type** (cp. technical data page 21) |
|---|
| B |
| A |

| **Mechanical interface** | |
|---|---|
| Through hollow shaft 8 mm | = **B** |
| Through hollow shaft 3/8" | = **C** |
| Through hollow shaft 10 mm | = **D** |
| Through hollow shaft 12 mm | = **E** |
| Through hollow shaft 1/2" | = **F** |
| Through hollow shaft 14 mm | = **G** |
| Through hollow shaft 15 mm | = **H** |

| **Electrical interface** | |
|---|---|
| 4.5 ... 32 V, SSI/Gray + Incremental, programmable | = **R *** |
| 4.5 ... 32 V, SSI/Gray programmable + Sin/Cos, 1,024 periods | = **S *** |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

| **Connection type** | |
|---|---|
| Connector M23, 12-pin, radial | = **A** |

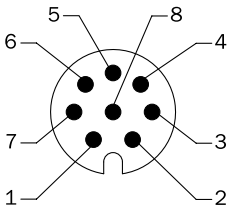
| **Resolution *** |
|---|
| Steps per rev. |

* Number of steps of 256 (8 bits) to 262144 (18 bits freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144;
Number of incremental lines is always 1/4 of number of SSI/Gray steps.

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn, 4096 revolutions,** |
| **Type B and A, through hollow shaft, SSI/Gray + Incremental** |
| **Model name** |
| AFM60B-TxRA032768 |
| AFM60A-TxRA262144 |

| **Order information programmable version** |
|---|
| **AFM60 Absolute Encoders Multiturn, 4096 revolutions,** |
| **Type B and A, through hollow shaft, SSI/Gray + Sin/Cos** |
| **Model name** |
| AFM60B-TxSA032768 |
| AFM60A-TxSA262144 |

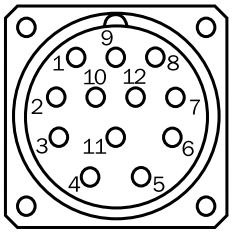
x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.




View to the connector M12
fitted to the encoder body

**Pin and wire allocation, connector M12, 8-pin**

| PIN, 8-pin M12 connector | Signal SSI | Explanation |
|---|---|---|
| 1 | Data – | Interface signals |
| 2 | Data + | Interface signals |
| 3 | CW/$\overline{\text{CCW}}$ | Counting sequence when turning |
| 4 | SET | Electronic adjustment |
| 5 | Clock + | Interface signals |
| 6 | Clock – | Interface signals |
| 7 | GND | Ground connection |
| 8 | $+U_S$ | Supply voltage |
| | Screen | Screen on the encoder side connected to the housing.<br>On the control side connected to earth. |




View to the connector M23
fitted to the encoder body

**Pin and wire allocation, SSI/Gray, connector M23, 12-pin**

| PIN | Signal | Explanation |
|---|---|---|
| 1 | GND | Earth connection |
| 2 | Data + | Interface signals |
| 3 | Clock + | Interface signals |
| 4 | N. C. | Not connected |
| 5 | N. C. | Not connected |
| 6 | N. C. | Not connected |
| 7 | N. C. | Not connected |
| 8 | $U_S$ | Supply voltage |
| 9 | SET | Electronic adjustment |
| 10 | Data – | Interface signals |
| 11 | Clock – | Interface signals |
| 12 | CW/$\overline{\text{CCW}}$ | Counting sequence when turning |
| | Screen | Screen on the encoder side connected to the housing.<br>On the control side connected to earth. |

**Pin and wire allocation, connector M23, 12-pin**

| | SSI/Gray + Incremental | | SSI/Gray + Sin/Cos | |
|---|---|---|---|---|
| PIN | Signal | Explanation | Signal | Explanation |
| 1 | $+U_S$ | Supply voltage | $+U_S$ | Supply voltage |
| 2 | GND | Earth connection | GND | Earth connection |
| 3 | Clock + | Interface signal | Clock + | Interface signal |
| 4 | Data + | Interface signal | Data + | Interface signal |
| 5 | SET | Electronic adjustment | SET | Electronic adjustment |
| 6 | Data – | Interface signal | Data – | Interface signal |
| 7 | Clock – | Interface signal | Clock – | Interface signal |
| 8 | $\overline{\text{B}}$ | Signal line | Sin – | Signal line |
| 9 | CW/$\overline{\text{CCW}}$ | Counting sequence when turning | CW/$\overline{\text{CCW}}$ | Counting sequence when turning |
| 10 | $\overline{\text{A}}$ | Signal line | Cos – | Signal line |
| 11 | A | Signal line | Cos + | Signal line |
| 12 | B | Signal line | Sin + | Signal line |
| | Screen | Screen on the encoder side connected to the housing.<br>On the control side connected to earth. | | |

**Allocation cable outlet, cable 8-core**

| Colour of wires | Signal | Explanation |
|---|---|---|
| Brown | Data – | Interface signals |
| White | Data + | Interface signals |
| Black | CW/$\overline{\text{CCW}}$ | Counting sequence when turning |
| Pink | SET | Electronic adjustment |
| Yellow | Clock + | Interface signals |
| Lilac | Clock – | Interface signals |
| Blue | GND | Earth connection |
| Red | $+ U_S$ | Supply voltage |
| | Screen | Screen on the encoder side connected to the housing.<br>On the control side connected to earth. |

CW/$\overline{\text{CCW}}$ Foreward/reverse:
This input programs the counting direction of the encoder. If not connected, this input is "HIGH". If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to "LOW" level (zero volts).

SET This input activates the electronic zero set. When the SET line is connected to Us for more than 250 ms, the current mechanical position is assigned the value 0 or the pre-programmed SET-value.

## Programming Tool for AFS60/AFM60

### Programming Tool

| Type | Part no. |
|---|---|
| PGT-08-S | 1036616 |

**For programming SICK Absolute Encoders with M12 or M23 connectors the following adapter cables are appropriate:**

**Adapter cable absolute SSI – PGT-08-S consists of male 9-pin SUB-D connector and M12 8-pin inline cable connector, pre-assembled using 8-core cable, 4 x 2 x 0.08 mm², screened, cable length 0.5 m**

| Model name | Part no. |
|---|---|
| DSL-2D08-G0M5AC2 | 2048439 |

**Adapter cable absolute SSI – PGT-08-S consists of male 9-pin SUB-D connector and M23 12-pin inline cable connector, pre-assembled using 8-core cable, 4 x 2 x 0.15 mm², screened, cable length 0.5 m**

| Model name | Part no. |
|---|---|
| DSL-3D08-G0M5AC2 | 2048440 |

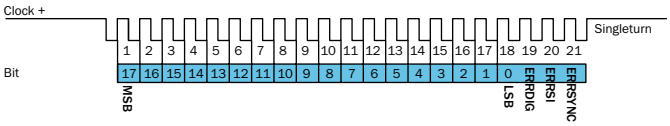
**Adapter cable absolute SSI + incremental and SSI + Sin/Cos – PGT-08-S consists of male 9-pin SUB-D connector and M23 12-pin inline cable connector, pre assembled using 8 core cable, 4 x 2 x 0,15 mm², screened, cable length 0.5 m**

| Model name | Part no. |
|---|---|
| DSL-3D08-G0M5AC4 | 2059270 |

**Caution:**
Attempting to programme an AFS/AFM60 Absolute Encoder with the adapter cables intended for use with the DFS60 incremental encoder will cause damage to the Absolute Encoder. Please ensure the correct adapter cable is used!

## Output signals

### SSI data format Singleturn




**Bit 1–18: Position Bits**
- LSB: Least significant Bit
- MSB: Most significant Bit

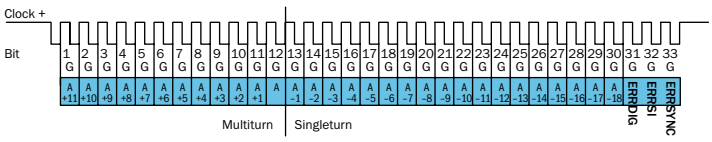
**Bit 19–21: Error Bits**
- ERRDIG: Failure message about speed. If this failure occurs during the position building procedure it will be indicated by the ERRDIG-Bit.
- ERRSI: Light source monitoring failure.
- ERRSYNC: Contamination of the disc or scanning system. During the determination of the position, an error has occurred since the last SSI transmission. The error bit will be deleted during the next data transmission.

**The evaluation of the error bits has to be realized in the PLC.**
The provided error bits don't have to be used by the PLC compulsorily.

**Example**
If the resolution of the absolute encoder is set on 13 bits, 16 bits are provided by the encoder: 13 data bits and 3 error bits.
If the PLC is not able to evaluate the error bits, the PLC has to be set on a resolution of 13 bits. Then the error bits have to be masked out by the PLC.

### SSI data format Multiturn

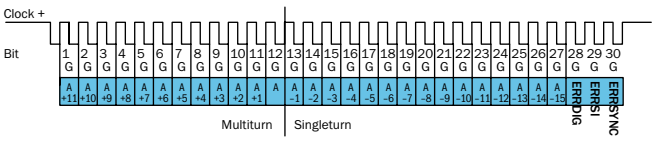
#### 30 Bits




**Bit 1–12: Position Bits Multiturn**
**Bit 13–30: Position Bits Singleturn**
**Bit 31–33: Error Bits**

**Error Bits**
- ERRDIG: Failure message about speed. If this failure occurs during the position building procedure it will be indicated by the ERRDIG-Bit.
- ERRSI: Light source monitoring failure.
- ERRSYNC: Contamination of the disc or scanning system. During the determination of the position, an error has occurred since the last SSI transmission. The error bit will be deleted during the next data transmission.

#### 27 Bits

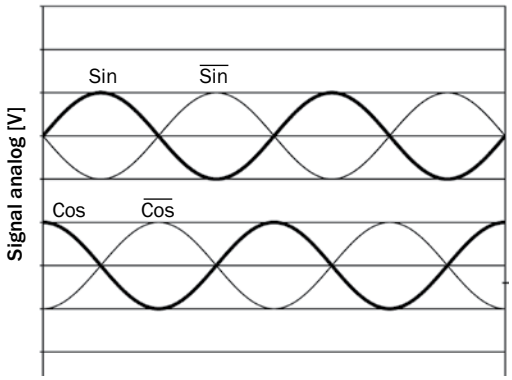



**Bit 1–12: Position Bits Multiturn**
**Bit 13–27: Position Bits Singleturn**
**Bit 28–30: Error Bits**

**The evaluation of the error bits has to be realized in the PLC.**
The provided error bits don't have to be used by the PLC compulsorily.
The multiturn resolution is fixed on 12 bits.

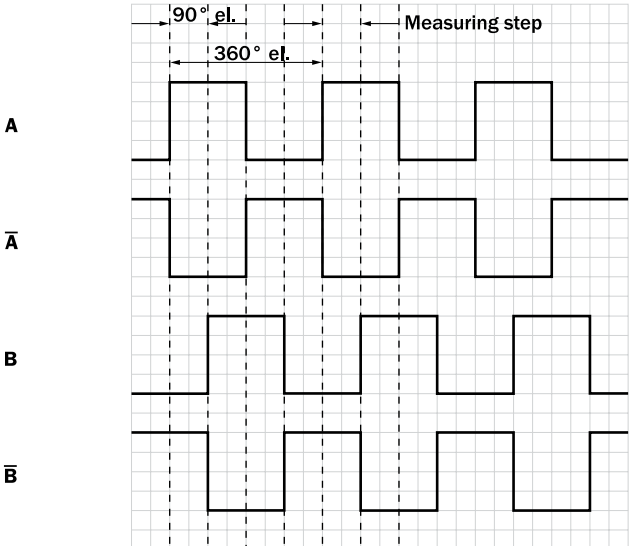
**Example**
If the resolution of the absolute encoder is set on 27 bits, 30 bits are provided by the encoder: 27 data bits and 3 error bits.
If the PLC is not able to evaluate the error bits, the PLC has to be set on a resolution of 27 bits. Then the error bits have to be masked out by the PLC.

## Sin/Cos signal diagram for clockwise rotation of the shaft looking in direction “A”, see dimensional drawing




| | |
|---|---|
| Interface signals Sin, $\overline{Sin}$, Cos, $\overline{Cos}$ | analog differential |
| Signal before differential generation at load 120 Ω | 0.5 $V_{PP}$ ± 20 % |
| Signal offset | 2.5 V ± 10 % |

## Incremental pulse diagram for clockwise rotation of the shaft looking in direction “A”, see dimensional drawing

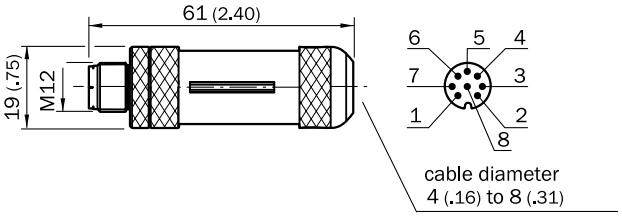


## Dimensional drawings and ordering information

### Round screw system M12

**Cable connector M12 male, 8-pin, straight, screened, for field assembly (adapter side)**

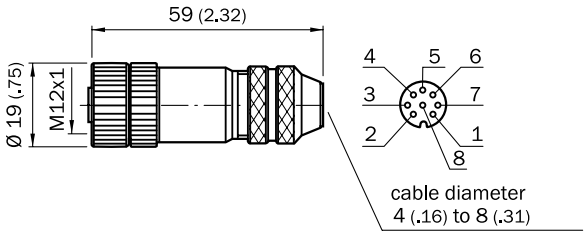
| Model name | Part no. | Contacts/cable diameter |
|---|---|---|
| STE-1208-GA01 | 6044892 | 8 / 4 ... 8 mm |




All dimensions in mm (inch)

**Cable connector M12 female, 8-pin, straight, screened, for field assembly (adapter side)**

| Model name | Part no. | Contacts/cable diameter |
|---|---|---|
| DOS-1208-GA01 | 6045001 | 8 / 4 ... 8 mm |

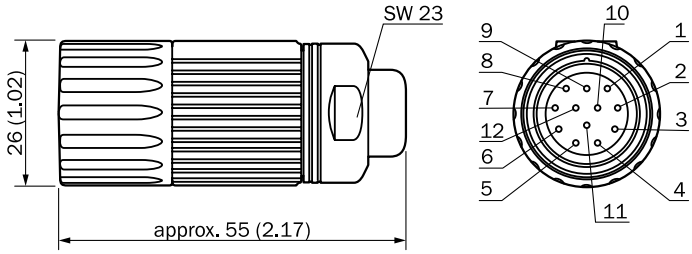



All dimensions in mm (inch)

### Screw-in system M23, 12-pin

**Cable connector M23 female, 12-pin, straight, screened**

| Model name | Part no. | Contacts |
|---|---|---|
| DOS-2312-G | 6027538 | 12 |

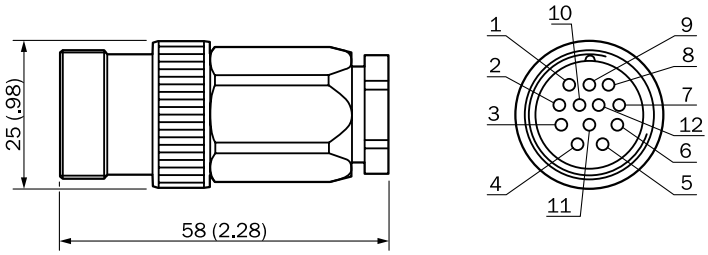



All dimensions in mm (inch)

General tolerances according to DIN ISO 2768-mk

**Cable connector M23 male, 12-pin, straight, screened**

| Model name | Part no. | Contacts |
|---|---|---|
| STE-2312-G | 6027537 | 12 |




All dimensions in mm (inch)

General tolerances according to DIN ISO 2768-mk

### Cables

**Cable 8-core, per metre, 4 x 2 x 0.15 mm², with screening, cable diameter 5.6 mm**

| Model name | Part no. | Wires |
|---|---|---|
| LTG-2308-MWENC | 6027529 | 8 |

**Cable 12-core, per metre, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm², with screening, capable of beeing dragged, cable diameter 7.8 mm**

| Model name | Part no. | Wires | Explanation |
|---|---|---|---|
| LTG-2612-MW | 6028516 | 12 | UV and salt water resistant |

## Dimensional drawings and ordering information

### Female connectors

**Cable connector female JST inc. sealing, 8-core, 4 x 2 x 0.15 mm², with screening, cable diameter 5.6 mm**

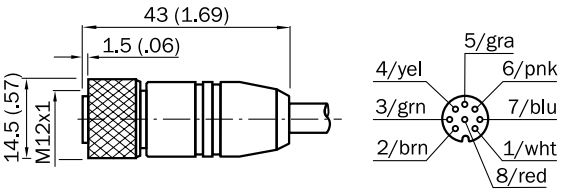
| Model name | Part no. | Cable length |
|---|---|---|
| DOL-0J08-G0M5AA6 | 2048589 | 0.5 m |
| DOL-0J08-G1M5AA6 | 2048590 | 1.5 m |
| DOL-0J08-G03MAA6 | 2048591 | 3.0 m |
| DOL-0J08-G05MAA6 | 2048593 | 5.0 m |
| DOL-0J08-G10MAA6 | 2048594 | 10.0 m |

**Cable connector female M23, 8-core, 4 x 2 x 0.15 mm², cable diameter 5.6 mm**

| Model name | Part no. | Cable length |
|---|---|---|
| DOL-2308-G0M5AA6 | 2048595 | 0.5 m |
| DOL-2308-G1M5AA6 | 2048596 | 1.5 m |
| DOL-2308-G03MAA6 | 2048597 | 3.0 m |
| DOL-2308-G05MAA6 | 2048598 | 5.0 m |
| DOL-2308-G10MAA6 | 2048599 | 10.0 m |

**Female connector M12, 8-pin, straight, pre-wired with cable 8-wire, 4 x 2 x 0.25 mm², screened, flexible (adapter side)**

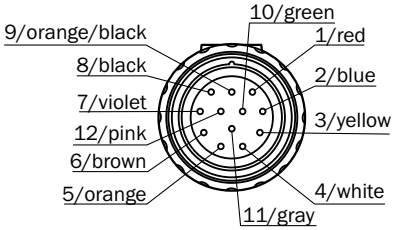
| Model name | Part no. | Contacts | Cable length |
|---|---|---|---|
| DOL-1208-G02MAC1 | 6032866 | 8 | 2.0 m |
| DOL-1208-G05MAC1 | 6032867 | 8 | 5.0 m |
| DOL-1208-G10MAC1 | 6032868 | 8 | 10.0 m |
| DOL-1208-G20MAC1 | 6032869 | 8 | 20.0 m |




All dimensions in mm (inch)

**Female connector M23, 12-pin, straight, cable 12-wire, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm² screened, capable of being dragged, cable diameter 7.8 mm for AFM60 SSI + Incremental and AFM60 SSI + Sin/Cos interface**

| Model name | Part no. | Contacts | Cable length |
|---|---|---|---|
| DOL-2312-G1M5MA6 | 2062284 | 12 | 1.5 m |
| DOL-2312-G03MMA6 | 2062300 | 12 | 3.0 m |
| DOL-2312-G05MMA6 | 2062301 | 12 | 5.0 m |
| DOL-2312-G10MMA6 | 2062302 | 12 | 10.0 m |
| DOL-2312-G20MMA6 | 2062303 | 12 | 20.0 m |
| DOL-2312-G30MMA6 | 2062304 | 12 | 30.0 m |

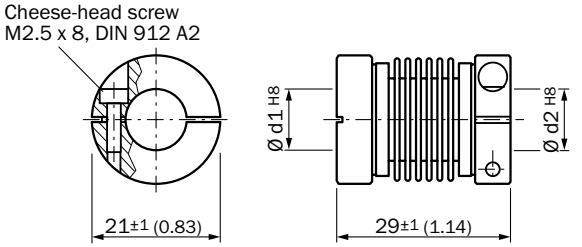


## Dimensional drawings and ordering information

### Couplings

**Bellows coupling, max. shaft offset radial ± 0.3 mm, axial 0.4 mm, angle ± 4 degrees, torsion spring stiffness 120 Nm/rad, bellows of stainless steel, hubs of aluminium**

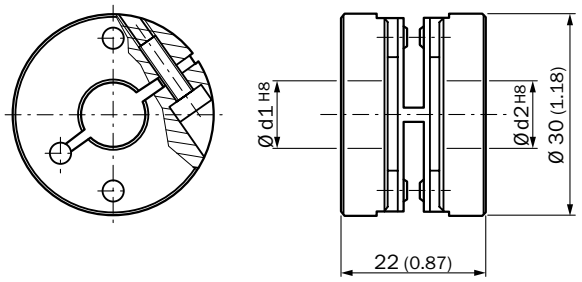
| Model name | Part no. | Shaft diameter |
|---|---|---|
| KUP-0606-B | 5312981 | 6 mm ... 6 mm |
| KUP-0610-B | 5312982 | 6 mm ... 10 mm |
| KUP-1010-B | 5312983 | 10 mm ... 10 mm |
| KUP-1012-B | 5312984 | 10 mm ... 12 mm |




All dimensions in mm (inch)

**Spring-disc coupling, max. shaft offset radial ± 0.3 mm, axial 0.4 mm, angle ± 2.5 degrees, torsion spring stiffness 50 Nm/rad, flange of aluminium, spring-discs of glass-fibre-reinforced plastic**

| Model name | Part no. | Shaft diameter |
|---|---|---|
| KUP-0610-F | 5312985 | 6 mm ... 10 mm |
| KUP-1010-F | 5312986 | 10 mm ... 10 mm |

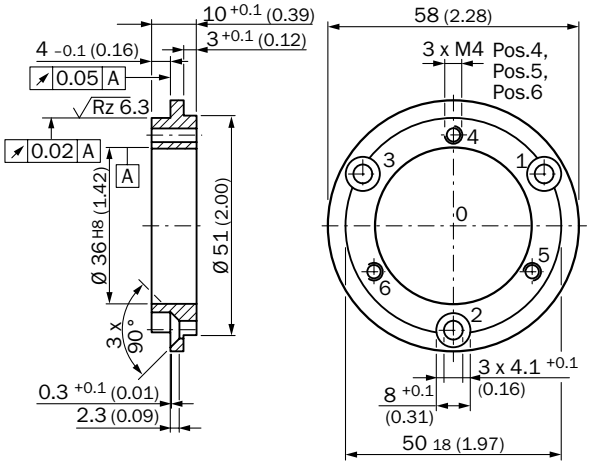



All dimensions in mm (inch)

### Mechanical Adapters

**Adapter flange of aluminium for face mount flange, spigot 36 mm**

| Model name | Part no. | Adaption |
|---|---|---|
| BEF-FA-036-050 | 2029160 | To 50 mm servo flange |



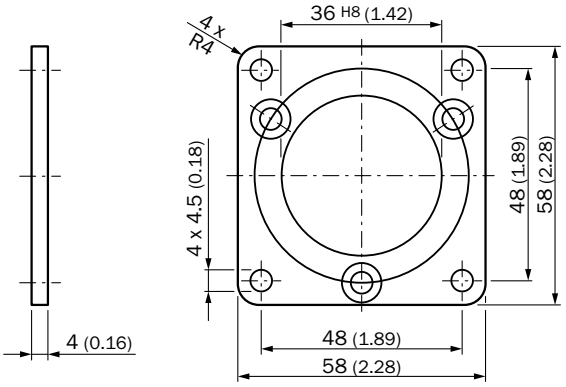

All dimensions in mm (inch)

## Dimensional drawings and ordering information

### Mechanical Adapters

**Adapter flange of aluminium for face mount flange, spigot 36 mm**

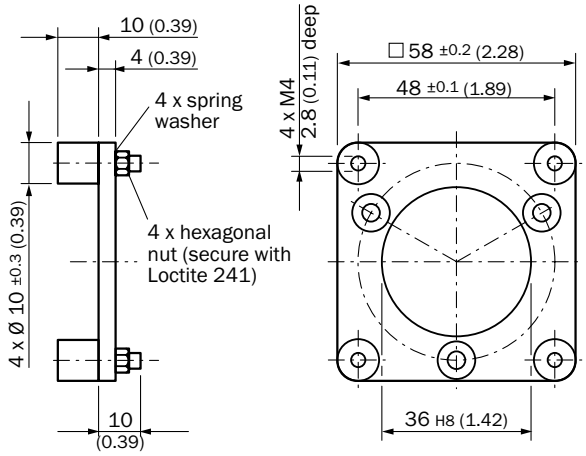
| Model name | Part no. | Adaption |
|---|---|---|
| BEF-FA-036-060REC | 2029162 | To 60 mm square mounting plate |




All dimensions in mm (inch)

**Adapter flange of aluminium for face mount flange, spigot 36 mm**

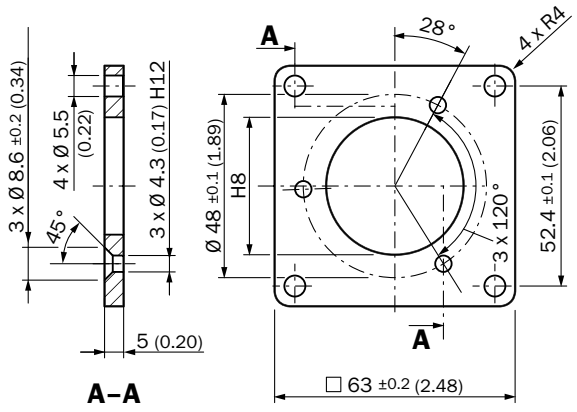
| Model name | Part no. | Adaption |
|---|---|---|
| BEF-FA-036-060RSA | 2029163 | To 60 mm square mounting plate with shock absorbers |




All dimensions in mm (inch)

**Adapter flange of aluminium for face mount flange, spigot 36 mm**

| Model name | Part no. | Adaption |
|---|---|---|
| BEF-FA-036-063REC | 2034225 | To 63 mm square mounting plate |



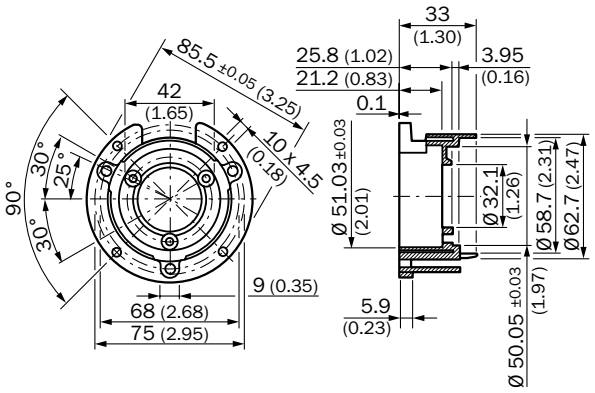

All dimensions in mm (inch)

## Dimensional drawings and ordering information

### Mechanical Adapters

**Mounting bell incl. fixing set for encoder with servo flange**

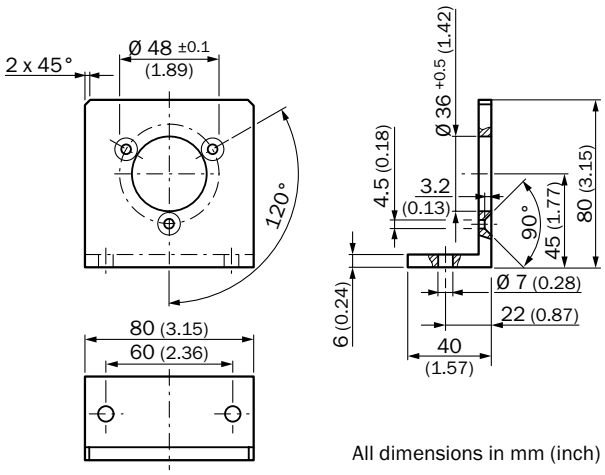
| Model name | Part no. | Flange spigot |
|---|---|---|
| BEF-MG-50 | 5312987 | Diameter 50 mm |




All dimensions in mm (inch)

**Mounting angle incl. fixing set for encoder with face mount flange**

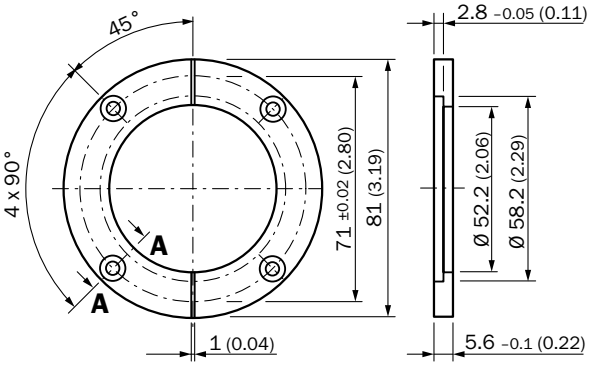
| Model name | Part no. | Flange spigot |
|---|---|---|
| BEF-WF-36 | 2029164 | Diameter 36 mm |




All dimensions in mm (inch)

**Servo clamps half ring, Set (comprises 2 pieces) for servo flanges with spigot diameter 50 mm**

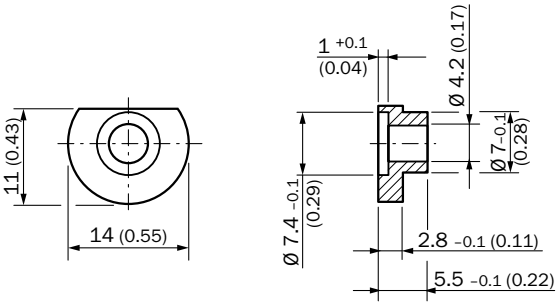
| Model name | Part no. |
|---|---|
| BEF-WG-SF050 | 2029165 |




All dimensions in mm (inch)

**Servo clamps small, Set (comprises 3 pieces) for servo flanges**

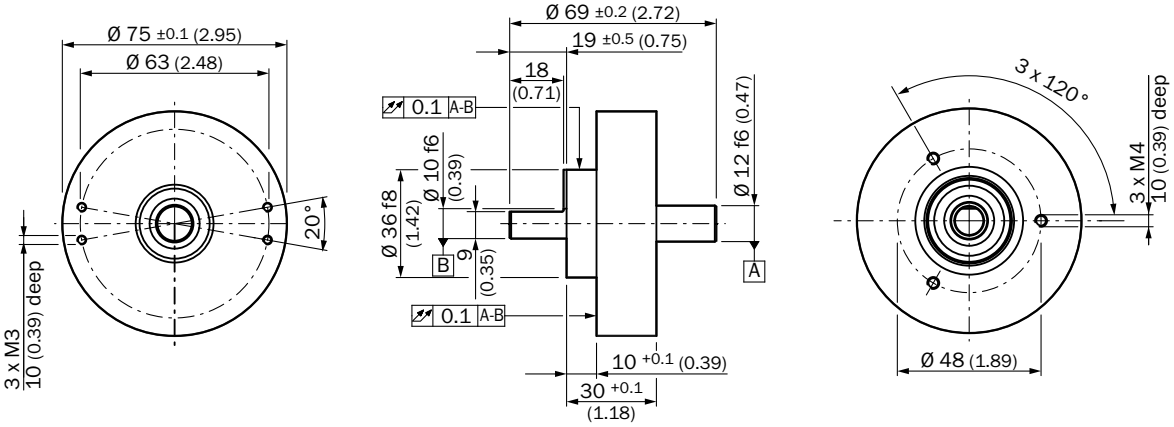
| Model name | Part no. |
|---|---|
| BEF-WK-SF | 2029166 |




All dimensions in mm (inch)

**Heavy duty bearing block for very large radial and axial shaft loads**

| Model name | Part no. |
|---|---|
| BEF-FA-B12-010 | 2042728 |

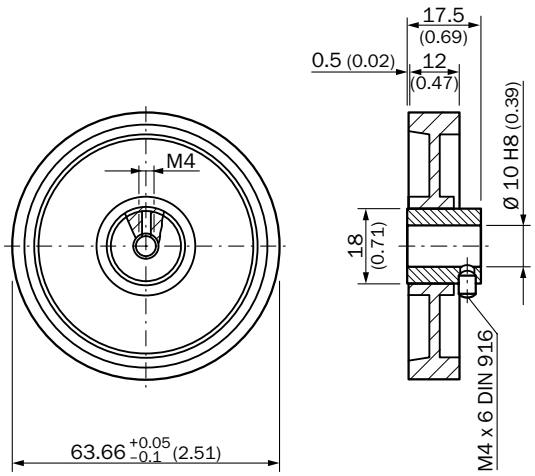



All dimensions in mm (inch)

## Dimensional drawings and ordering information

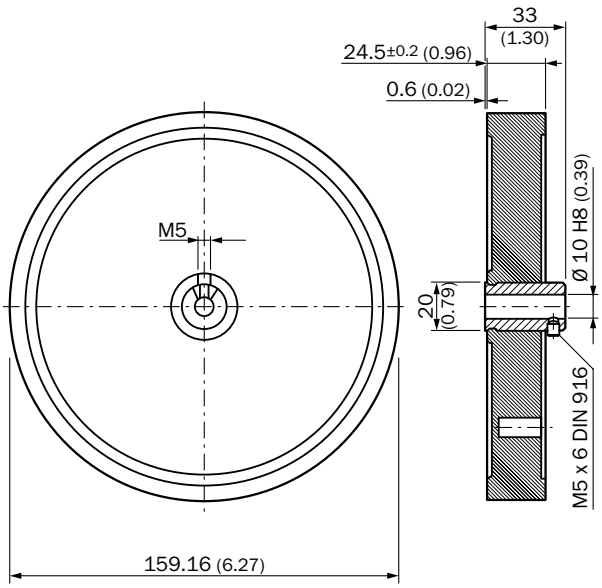
### Measuring wheels

| Measuring wheel for encoder shafts with diameter 10 mm, type material plastic (Hytrel), wheel material plastic with aluminium hub | | | |
|---|---|---|---|
| **Model name** | **Part no.** | **Circumference** | **Surface** |
| BEF-MR-010020 | 5312988 | 0.2 m | Smooth |
| BEF-MR-010020G | 5318678 | 0.2 m | Knurled |



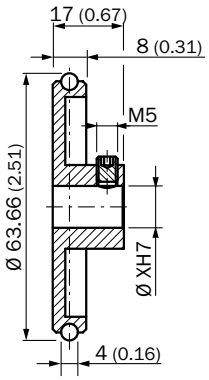

All dimensions in mm (inch)

| Measuring wheel for encoder shafts with diameter 10 mm, type material plastic (Hytrel), wheel material plastic with aluminium hub | | | |
|---|---|---|---|
| **Model name** | **Part no.** | **Circumference** | **Surface** |
| BEF-MR-010050 | 5312989 | 0.5 m | Smooth |




All dimensions in mm (inch)

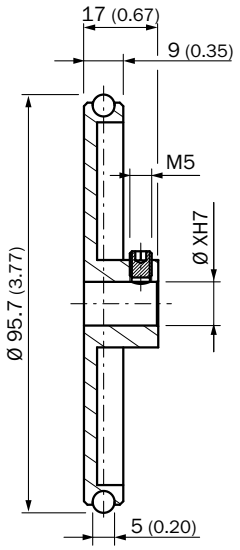
| Measuring wheel, circumference 200 mm, for encoder shafts with 6, 8 or 10 mm | | | | |
|---|---|---|---|---|
| **Model name** | **Part no.** | **Bore Ø** | **Circumference** | **Surface** |
| BEF-MR006020R | 2055222 | 6 mm | 200 mm | O ring NBR70 |
| BEF-MR008020R | 2055223 | 8 mm | 200 mm | O ring NBR70 |
| BEF-MR010020R | 2055224 | 10 mm | 200 mm | O ring NBR70 |




All dimensions in mm (inch)

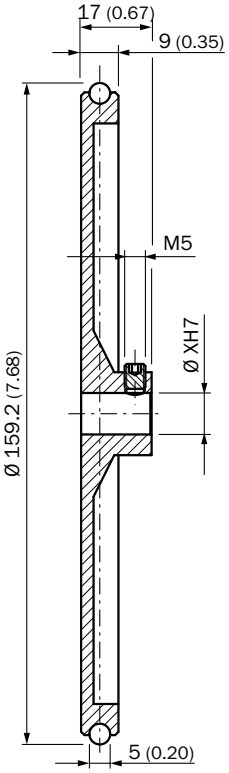
## Dimensional drawings and ordering information

| Measuring wheel, circumference 300 mm, for encoder shafts with 6, 8 or 10 mm | | | | |
|---|---|---|---|---|
| **Model name** | **Part no.** | **Bore Ø** | **Circumference** | **Surface** |
| BEF-MR006030R | 2055634 | 6 mm | 300 mm | O ring NBR70 |
| BEF-MR008030R | 2055635 | 8 mm | 300 mm | O ring NBR70 |
| BEF-MR010030R | 2049278 | 10 mm | 300 mm | O ring NBR70 |




All dimensions in mm (inch)

| Measuring wheel, circumference 500 mm, for encoder shafts with 6, 8 or 10 mm | | | | |
|---|---|---|---|---|
| **Model name** | **Part no.** | **Bore Ø** | **Circumference** | **Surface** |
| BEF-MR006050R | 2055225 | 6 mm | 500 mm | O ring NBR70 |
| BEF-MR008050R | 2055226 | 8 mm | 500 mm | O ring NBR70 |
| BEF-MR010050R | 2055227 | 10 mm | 500 mm | O ring NBR70 |




All dimensions in mm (inch)

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