



Absolute encoders AFS/AFM60 SSI

AFM60E-TGAK001024

Model Name > [AFM60E-TGAK001024](#)
Part No. > [1053254](#)



At a glance

- High-resolution absolute encoders with up to 30 bits (AFM60) or up to 18 bits (AFS60)
- Face mount flange, servo flange, blind or through hollow shaft
- SSI, SSI + Incremental or SSI + Sin/Cos interface
- Programmable resolution and offset (dependent on type)
- Connection system: M12, M23 connector or cable outlet
- Enclosure rating: IP 67 (housing), IP 65 (shaft)
- Operating temperature: -30 °C to +100 °C (depends on type)

Your benefits

- Programmability of the encoders means less storage, greater machine availability and easy installation
- Precise positioning due to high resolutions
- Large selection of mechanical interfaces and electrical contacting possibilities: Suitable for all applications
- Suitable for applications with limited space requirements (extremely short installation depth of 30 mm)
- Very good rotation accuracy due to increased bearing distance
- One programming tool and software with automatic encoder detection for AFS60/AFM60/DFS60



Performance

Max. number of steps per revolution:	1,024
Max. number of revolutions:	4,096
Resolution power:	1,024 x 4,096
Resolution:	10 bit x 12 bit
Error limits:	± 0.3 °
Repeatability (Ta not constant):	0.002 °
Measuring step deviation:	± 0.2 °
Measuring step:	0.09 ° 360 ° / number of steps
Initialization time:	50 ms ¹⁾

¹⁾ Valid positional data can be read once this time has elapsed

Mechanical data

Mechanical interface:	Through hollow shaft
Shaft diameter:	14 mm

Start up torque:	0.8 Ncm (+20 °C)
Operating torque:	0.6 Ncm (+20 °C)
Maximum operating speed:	9,000 /min ¹⁾
Moment of inertia of the rotor:	40 gcm ²
Bearing lifetime:	3.0 x 10 ⁹ revolutions
Max. angular acceleration:	500,000 rad/s ²
Permissible movement axial static/dynamic:	± 0.5 mm, ± 0.2 mm
Permissible movement radial static/dynamic:	± 0.3 mm, ± 0.1 mm

¹⁾ Self warming of 3.3 K per 1000 revolutions/min when applying note working temperature range

Electrical data

Power consumption:	0.5 W (without load)
Operating voltage range:	4.5 V DC ... 32 V DC
MTTFd: mean time to dangerous failure:	250 a (EN ISO 13849-1) ¹⁾
Connection type:	Cable, 8-wire, universal, 1.5 m ²⁾
Code type:	Gray
Code sequence:	CW/CCW, parameter adjustable
Reverse polarity protection:	1

¹⁾ This product is a standard product and does not constitute a safety component as defined in the Machinery Directive.

Calculation based on nominal load of components, average ambient temperature 40°C, frequency of use 8760 h/a. All

electronic failures are considered hazardous. For more information, see document no. 8015532. ²⁾ 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

Interfaces

Electrical interface:	SSI/Gray
Interface signals:	Clock +, Clock -, Data +, Data- ¹⁾
Clock frequency:	1 MHz
SET (electronic adjustment):	H-active (L ≡ 0 - 1,5 V, H ≡ 2,0 - Us V)
CW/CCW (counting sequence when turning):	L-active (L ≡ 0 - 1,5 V, H ≡ 2,0 - Us V)

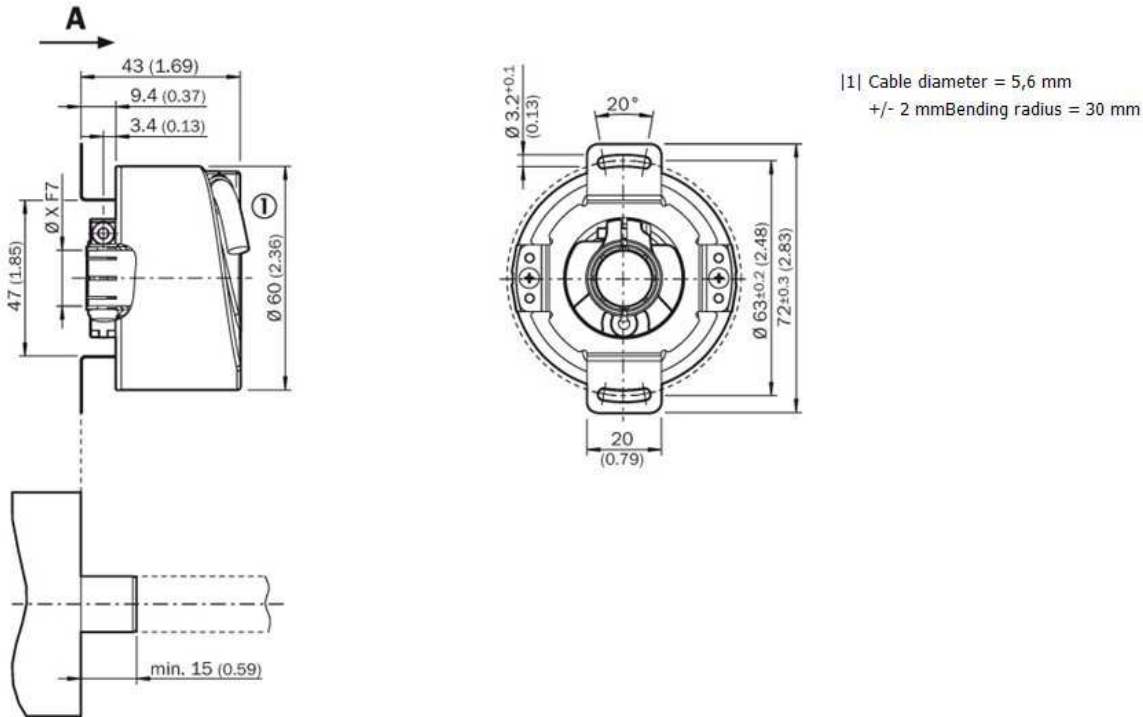
¹⁾

Ambient data

EMC:	(according to EN 61000-6-2 and EN 61000-6-3) ¹⁾
Enclosure rating:	IP 65 (according to IEC 60529), housing side, IP 65 (according to IEC 60529), shaft side
Permissible relative humidity:	90 % (condensation of the optical scanning not permitted)
Working temperature range:	0 °C ... +85 °C
Storage temperature range:	-40 °C ... +100 °C, without package
Resistance to shocks:	50 g, 6 ms (according to EN 60068-2-27)
Resistance to vibration:	20 g, 10 Hz ... 2,000 Hz (according to EN 60068-2-6)

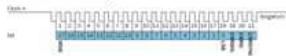
¹⁾

Dimensional drawing



Signalausgänge

SSI data format singletum



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.
- ERRSL: 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.

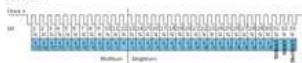
The provided error bits don't have to be used by the PLC compulsorily.

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.

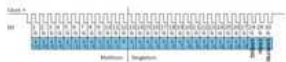
SSI data format multitum

30 Bits



- Bit 1-12: Position Bits multitum
- Bit 13-30: Position Bits singletum
- Bit 31-33: Error Bits

27 Bits



- Bit 1-12: Position Bits multitum
- Bit 13-27: Position Bits singletum
- Bit 28-30: 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.
- ERRSL: 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. The multitum 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.

The graph shows the relationship between speed and steps per revolution. The y-axis, labeled 'Steps per revolution', ranges from 16384 to 262144. The x-axis, labeled 'Speed N [min⁻¹]', ranges from 0 to 12000. A blue curve starts at a high value for low speed and decreases as speed increases, approaching a horizontal asymptote.

Electrical interfaces also 0.5 V_{cc}

Power supply: **Signal**
 0.5 V_{cc} - 0.5 V_{cc} → $\text{max}(\text{min}) = 0.5 \text{ V}_{\text{cc}}$

Signal before differential generation at load 120 Ω at $U_{\text{in}} = 5 \text{ V}$

Signal diagram for clockwise rotation of the shaft looking in direction "K" (shaft)

Signal before differential generation at load 120 Ω at $U_{\text{in}} = 5 \text{ V}$

Signal diagram for counter-clockwise rotation of the shaft looking in direction "K" (shaft)

Timing diagram for 100 Hz, 100 V_{cc}, 100 Ω

Signal before differential generation at load 120 Ω

Signal after differential generation at load 120 Ω at $U_{\text{in}} = 5 \text{ V}$

Signal diagram for clockwise rotation of the shaft looking in direction "K" (shaft)

Timing diagram for 100 Hz, 100 V_{cc}, 100 Ω

Signal before differential generation at load 120 Ω

Signal after differential generation at load 120 Ω at $U_{\text{in}} = 5 \text{ V}$

Signal diagram for counter-clockwise rotation of the shaft looking in direction "K" (shaft)

Dimensional drawing diagrams for clockwise rotation of the shaft looking in direction "K": see dimensional drawing

A

B

C

D

[illegible]

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