



Absolute encoders AFS/AFM60 SSI

AFM60A-THPM262144

Model Name > [AFM60A-THPM262144](#)
Part No. > [AFM60A-THPM262144](#)

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:	262,144
Max. number of revolutions:	4,096
Resolution power:	262,144 x 4,096
Resolution:	18 bit x 12 bit
Error limits:	± 0.03 °
Repeatability (Ta not constant):	0.002 °
Measuring step deviation:	± 0.002 °
Measuring step:	0.014 °
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:	15 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, ± 0.01 mm
Permissible movement radial static/dynamic:	± 0.3 mm, ± 0.05 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⁾

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.

Interfaces

Electrical interface:	Cable, 8-pin, universal, 5 m ¹⁾
Interface signals:	Clock +, Clock -, Data +, Data- ²⁾
Clock frequency:	2 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)

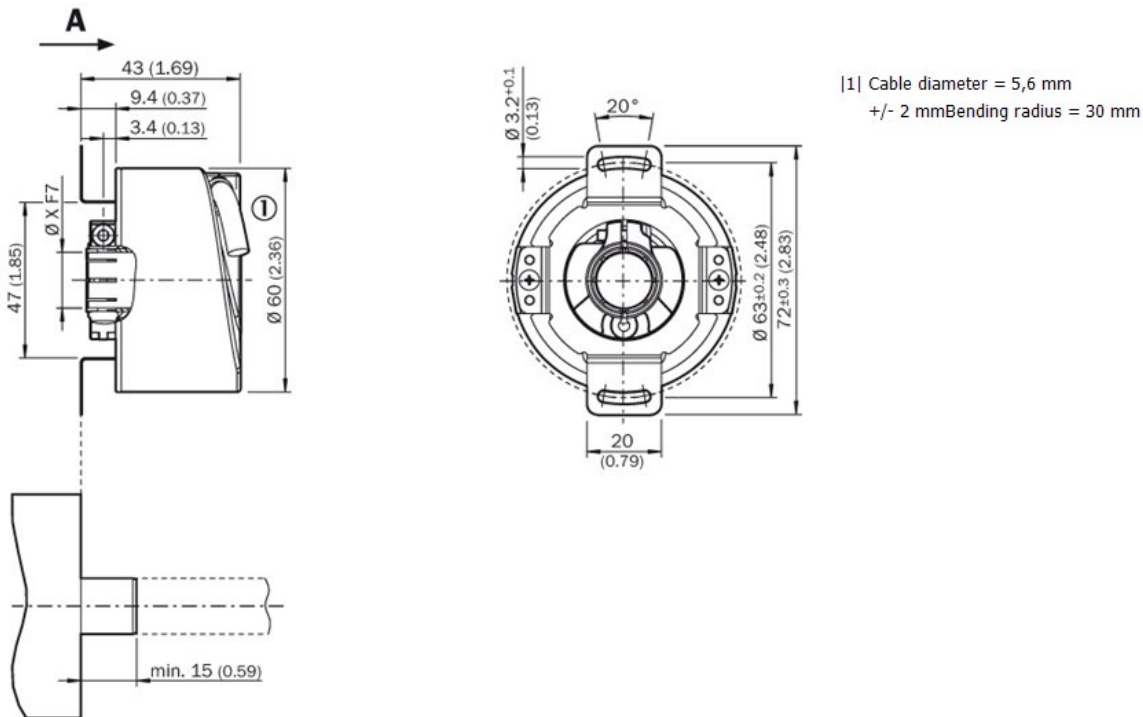
¹⁾ The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it ²⁾

Ambient data

EMC:	(according to EN 61000-6-2 and EN 61000-6-3) ¹⁾
Enclosure rating:	IP 65 (according to IEC 60529), IP 65 (according to IEC 60529), shaft side
Permissible relative humidity:	90 % (condensation of the optical scanning not permitted)
Working temperature range:	-30 °C ... 100 °C
Storage temperature range:	-40 °C ... 100 °C, without package
Resistance to shocks:	60 g (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.

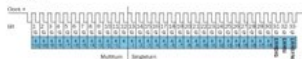
The provided error bits don't have to be used by the PLC compulsorily.

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.

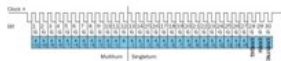
SSI data format multitum

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.

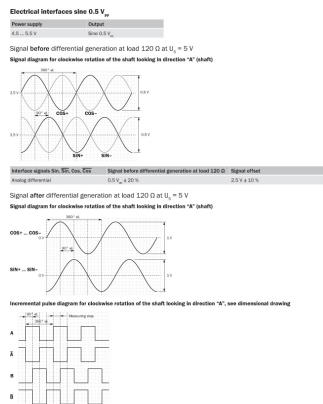
The provided error bits don't have to be used by the PLC compulsorily. The multitum resolution is fixed on 12 bits.

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 illustrates the relationship between the speed of the motor (N in min^{-1}) and the number of steps per revolution. The y-axis represents 'Steps per revolution' with values ranging from 16,384 to 262,144. The x-axis represents 'Speed N [min^{-1}]' with values from 0 to 12,000. The curve shows that as the speed increases, the number of steps per revolution decreases, following a non-linear relationship.

Interfaces



SSI data format signatures

Bit 15-16: Position Bits

- **ELSD** Least significant bit
- **ELMS** Most significant bit

Bit 15-16: Error Bits

- **ERRID** Error ID
- **ERRLOC** Error location
- **ERRMSG** Error message
- **ERRDATA** Error data
- **ERRTIME** Error time
- **ERRSTATUS** Error status
- **ERRCOUNT** Error count
- **ERRSEVERITY** Error severity
- **ERRPRIORITY** Error priority
- **ERRREASON** Error reason
- **ERRACTION** Error action
- **ERRRECOMMENDATION** Error recommendation
- **ERRREFERENCE** Error reference
- **ERRNOTES** Error notes
- **ERRCONTACT** Error contact
- **ERRRESOLUTION** Error resolution
- **ERRCLOSURE** Error closure
- **ERRREMARKS** Error remarks
- **ERRSIGNED** Error signed
- **ERRUNIQUE** Error unique
- **ERRVALID** Error valid
- **ERRRESERVED** Error reserved
- **ERRUNKNOWN** Error unknown
- **ERRNULL** Error null
- **ERRZERO** Error zero
- **ERRONE** Error one
- **ERRTWO** Error two
- **ERRTHREE** Error three
- **ERRFOUR** Error four
- **ERRFIVE** Error five
- **ERRSIX** Error six
- **ERRSEVEN** Error seven
- **ERREIGHT** Error eight
- **ERRNINE** Error nine
- **ERRTEN** Error ten
- **ERRELEVEN** Error eleven
- **ERRTWELVE** Error twelve
- **ERRTHIRTEEN** Error thirteen
- **ERRFOURTEEN** Error fourteen
- **ERRFIFTEEN** Error fifteen
- **ERRSIXTEEN** Error sixteen
- **ERRSEVENTEEN** Error seventeen
- **ERREIGHTEEN** Error eighteen
- **ERRNINETEEN** Error nineteen
- **ERRTWENTY** Error twenty
- **ERRTWENTYONE** Error twenty one
- **ERRTWENTYTWO** Error twenty two
- **ERRTWENTYTHREE** Error twenty three
- **ERRTWENTYFOUR** Error twenty four
- **ERRTWENTYFIVE** Error twenty five
- **ERRTWENTYSIX** Error twenty six
- **ERRTWENTYSEVEN** Error twenty seven
- **ERRTWENTYEIGHT** Error twenty eight
- **ERRTWENTYNINE** Error twenty nine
- **ERRTHIRTY** Error thirty
- **ERRTHIRTYONE** Error thirty one
- **ERRTHIRTYTWO** Error thirty two
- **ERRTHIRTYTHREE** Error thirty three
- **ERRTHIRTYFOUR** Error thirty four
- **ERRTHIRTYFIVE** Error thirty five
- **ERRTHIRTYSIX** Error thirty six
- **ERRTHIRTYSEVEN** Error thirty seven
- **ERRTHIRTYEIGHT** Error thirty eight
- **ERRTHIRTYNINE** Error thirty nine
- **ERRFORTY** Error forty
- **ERRFORTYONE** Error forty one
- **ERRFORTYTWO** Error forty two
- **ERRFORTYTHREE** Error forty three
- **ERRFORTYFOUR** Error forty four
- **ERRFORTYFIVE** Error forty five
- **ERRFORTYSIX** Error forty six
- **ERRFORTYSEVEN** Error forty seven
- **ERRFORTYEIGHT** Error forty eight
- **ERRFORTYNINE** Error forty nine
- **ERRFIFTY** Error fifty
- **ERRFIFTYONE** Error fifty one
- **ERRFIFTYTWO** Error fifty two
- **ERRFIFTYTHREE** Error fifty three
- **ERRFIFTYFOUR** Error fifty four
- **ERRFIFTYFIVE** Error fifty five
- **ERRFIFTYSIX** Error fifty six
- **ERRFIFTYSEVEN** Error fifty seven
- **ERRFIFTYEIGHT** Error fifty eight
- **ERRFIFTYNINE** Error fifty nine
- **ERRSIXTY** Error sixty
- **ERRSIXTYONE** Error sixty one
- **ERRSIXTYTWO** Error sixty two
- **ERRSIXTYTHREE** Error sixty three
- **ERRSIXTYFOUR** Error sixty four
- **ERRSIXTYFIVE** Error sixty five
- **ERRSIXTYSIX** Error sixty six
- **ERRSIXTYSEVEN** Error sixty seven
- **ERRSIXTYEIGHT** Error sixty eight
- **ERRSIXTYNINE** Error sixty nine
- **ERRSEVENTY** Error seventy
- **ERRSEVENTYONE** Error seventy one
- **ERRSEVENTYTWO** Error seventy two
- **ERRSEVENTYTHREE** Error seventy three
- **ERRSEVENTYFOUR** Error seventy four
- **ERRSEVENTYFIVE** Error seventy five
- **ERRSEVENTYSIX** Error seventy six
- **ERRSEVENTYSEVEN** Error seventy seven
- **ERRSEVENTYEIGHT** Error seventy eight
- **ERRSEVENTYNINE** Error seventy nine
- **ERREIGHTY** Error eighty
- **ERREIGHTYONE** Error eighty one
- **ERREIGHTYTWO** Error eighty two
- **ERREIGHTYTHREE** Error eighty three
- **ERREIGHTYFOUR** Error eighty four
- **ERREIGHTYFIVE** Error eighty five
- **ERREIGHTYSIX** Error eighty six
- **ERREIGHTYSEVEN** Error eighty seven
- **ERREIGHTYEIGHT** Error eighty eight
- **ERREIGHTYNINE** Error eighty nine
- **ERRNINETY** Error ninety
- **ERRNINETYONE** Error ninety one
- **ERRNINETYTWO** Error ninety two
- **ERRNINETYTHREE** Error ninety three
- **ERRNINETYFOUR** Error ninety four
- **ERRNINETYFIVE** Error ninety five
- **ERRNINETYSIX** Error ninety six
- **ERRNINETYSEVEN** Error ninety seven
- **ERRNINETYEIGHT** Error ninety eight
- **ERRNINETYNINE** Error ninety nine
- **ERRHUNDRED** Error hundred
- **ERRHUNDREDONE** Error hundred one
- **ERRHUNDREDTWO** Error hundred two
- **ERRHUNDREDTHREE** Error hundred three
- **ERRHUNDREDFOUR** Error hundred four
- **ERRHUNDREDFIVE** Error hundred five
- **ERRHUNDREDSIX** Error hundred six
- **ERRHUNDREDSEVEN** Error hundred seven
- **ERRHUNDREDEIGHT** Error hundred eight
- **ERRHUNDREDNINE** Error hundred nine
- **ERRHUNDREDTEN** Error hundred ten
- **ERRHUNDREDELEVEN** Error hundred eleven
- **ERRHUNDREDTWELVE** Error hundred twelve
- **ERRHUNDREDTHIRTEEN** Error hundred thirteen
- **ERRHUNDREDFOURTEEN** Error hundred fourteen
- **ERRHUNDREDFIFTEEN** Error hundred fifteen
- **ERRHUNDREDSIXTEEN** Error hundred sixteen
- **ERRHUNDREDSEVENTEEN** Error hundred seventeen
- **ERRHUNDREDEIGHTEEN** Error hundred eighteen
- **ERRHUNDREDNINETEEN** Error hundred nineteen
- **ERRHUNDREDTWENTY** Error hundred twenty
- **ERRHUNDREDTWENTYONE** Error hundred twenty one
- **ERRHUNDREDTWENTYTWO** Error hundred twenty two
- **ERRHUNDREDTWENTYTHREE** Error hundred twenty three
- **ERRHUNDREDTWENTYFOUR** Error hundred twenty four
- **ERRHUNDREDTWENTYFIVE** Error hundred twenty five
- **ERRHUNDREDTWENTYSIX** Error hundred twenty six
- **ERRHUNDREDTWENTYSEVEN** Error hundred twenty seven
- **ERRHUNDREDTWENTYEIGHT** Error hundred twenty eight
- **ERRHUNDREDTWENTYNINE** Error hundred twenty nine
- **ERRHUNDREDTHIRTY** Error hundred thirty
- **ERRHUNDREDTHIRTYONE** Error hundred thirty one
- **ERRHUNDREDTHIRTYTWO** Error hundred thirty two
- **ERRHUNDREDTHIRTYTHREE** Error hundred thirty three
- **ERRHUNDREDTHIRTYFOUR** Error hundred thirty four
- **ERRHUNDREDTHIRTYFIVE** Error hundred thirty five
- **ERRHUNDREDTHIRTYSIX** Error hundred thirty six
- **ERRHUNDREDTHIRTYSEVEN** Error hundred thirty seven
- **ERRHUNDREDTHIRTYEIGHT** Error hundred thirty eight
- **ERRHUNDREDTHIRTYNINE** Error hundred thirty nine
- **ERRHUNDREDFORTY** Error hundred forty
- **ERRHUNDREDFORTYONE** Error hundred forty one
- **ERRHUNDREDFORTYTWO** Error hundred forty two
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- **ERRHUNDREDFORTYEIGHT** Error hundred forty eight
- **ERRHUNDREDFORTYNINE** Error hundred forty nine
- **ERRHUNDREDFIFTY** Error hundred fifty
- **ERRHUNDREDFIFTYONE** Error hundred fifty one
- **ERRHUNDREDFIFTYTWO** Error hundred fifty two
- **ERRHUNDREDFIFTYTHREE** Error hundred fifty three
- **ERRHUNDREDFIFTYFOUR** Error hundred fifty four
- **ERRHUNDREDFIFTYFIVE** Error hundred fifty five
- **ERRHUNDREDF**

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