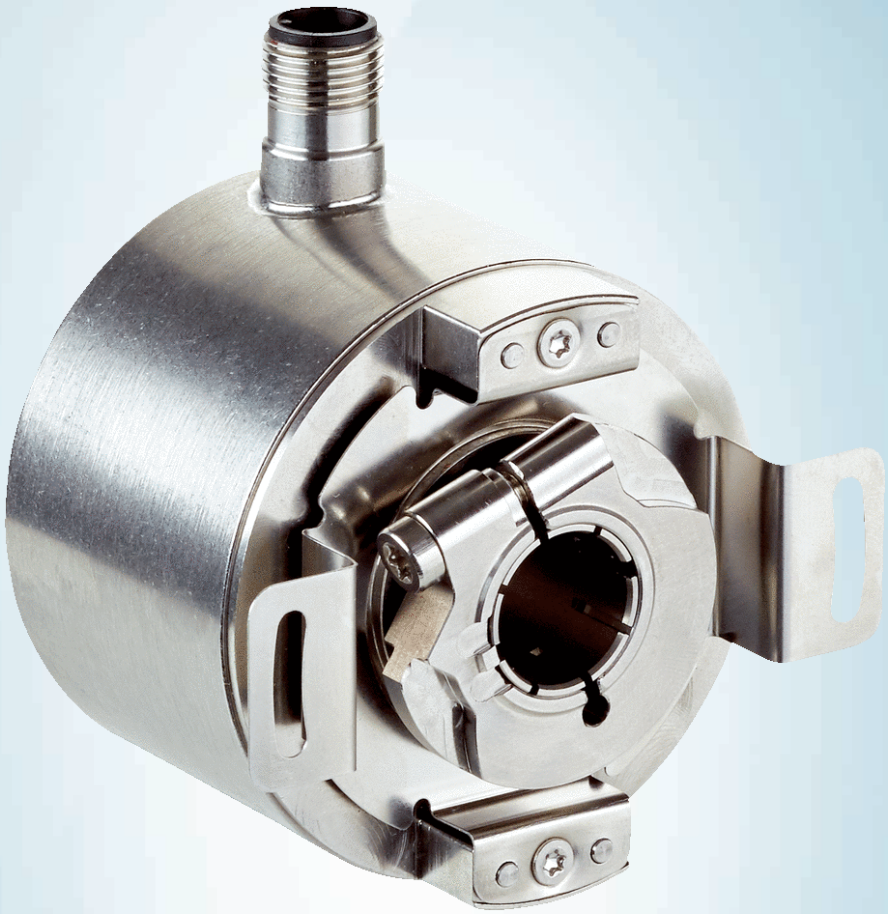
Product data sheet



AFM60I-BDRC262144

AFS/AFM60 Inox

ABSOLUTE ENCODERS

SICK
Sensor Intelligence.

Illustration may differ

Ordering information

Type	Part no.
AFM60I-BDRC262144	1083989

Other models and accessories ➜ www.sick.com/AFS_AFM60_Inox

Detailed technical data

Performance

Max. resolution (number of steps per revolution x number of revolutions)	18 bit x 12 bit (262,144 x 4,096)
Error limits G	0.03° [1]
Repeatability standard deviation σ_r	0.002° [2]

[1] In accordance with DIN ISO 1319-1, position of the upper and lower error limit depends on the installation situation, specified value refers to a symmetrical position, i.e. deviation in upper and lower direction is the same.
[2] In accordance with DIN ISO 55350-13; 68.3% of the measured values are inside the specified area.

Interfaces

Communication interface	SSI
Communication Interface detail	SSI + incremental
Initialization time	50 ms [1]
Position forming time	< 1 µs
SSI	
Code type	Gray
Code sequence parameter adjustable	CW/CCW (V/R)
Clock frequency	2 MHz [2]
Set (electronic adjustment)	H-active (L = 0 - 3 V, H = 4,0 - U_s V)
CW/CCW (counting sequence when turning)	L-active (L = 0 - 1,5 V, H = 2,0 - Us V)
Incremental	
Pulses per revolution	1/4 of number of SSI steps per revolution
Output frequency	≤ 820 kHz
Load current	≤ 30 mA

[1] Valid positional data can be read once this time has elapsed.
[2] SSI max. clock frequency 2 MHz, and min. LOW level (Clock+): 500 ns.

Electrical data

Connection type	Male connector, M12, 12-pin, radial
Supply voltage	4.5 ... 32 V DC
	Male connector, M12, 12-pin
Output frequency	≤ 820 kHz
Power consumption	≤ 0.7 W (without load)
Reverse polarity protection	✓
MTTFd: mean time to dangerous failure	250 years [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.

Mechanical data

Mechanical design	Blind hollow shaft
Shaft diameter	10 mm
Weight	0.5 kg [1]
Shaft material	Stainless steel V2A
Flange material	Stainless steel V2A
Housing material	Stainless steel V2A
Start up torque	1 Ncm
Operating torque	0.5 Ncm
Permissible shaft movement, axial static/dynamic	± 0.5 mm, ± 0.1 mm
Permissible shaft movement, radial static/dynamic	± 0.3 mm, ± 0.1 mm
Permissible Load capacity of shaft	80 N / radial 40 N / axial
Moment of inertia of the rotor	40 gcm²
Bearing lifetime	3.0 x 10^9 revolutions
Angular acceleration	≤ 500,000 rad/s²
Operating speed	≤ 6,000 min^{-1} [2]

[1] Relates to devices with male connector connection.

[2] Allow for self-heating of 3.3 K per 1,000 rpm when designing the operating temperature range.

Ambient data

EMC	According to EN 61000-6-2 and EN 61000-6-3 [1]
Enclosure rating	IP67, shaft side IP67, housing side, male connector connection [2] IP67, housing side, cable connection
Permissible relative humidity	90 % (condensation of the optical scanning not permitted)
Operating temperature range	–40 °C ... +100 °C [3] –30 °C ... +100 °C [4]

[1] EMC according to the standards quoted is achieved if shielded cables are used.

[2] With mating connector fitted.

[3] Stationary position of the cable.

[4] Flexible position of the cable.

Storage temperature range	–40 °C ... +100 °C, without package
Resistance to shocks	100 g, 6 ms (according to EN 60068-2-27)
Resistance to vibration	10 g, 10 Hz ... 2,000 Hz (according to EN 60068-2-6)

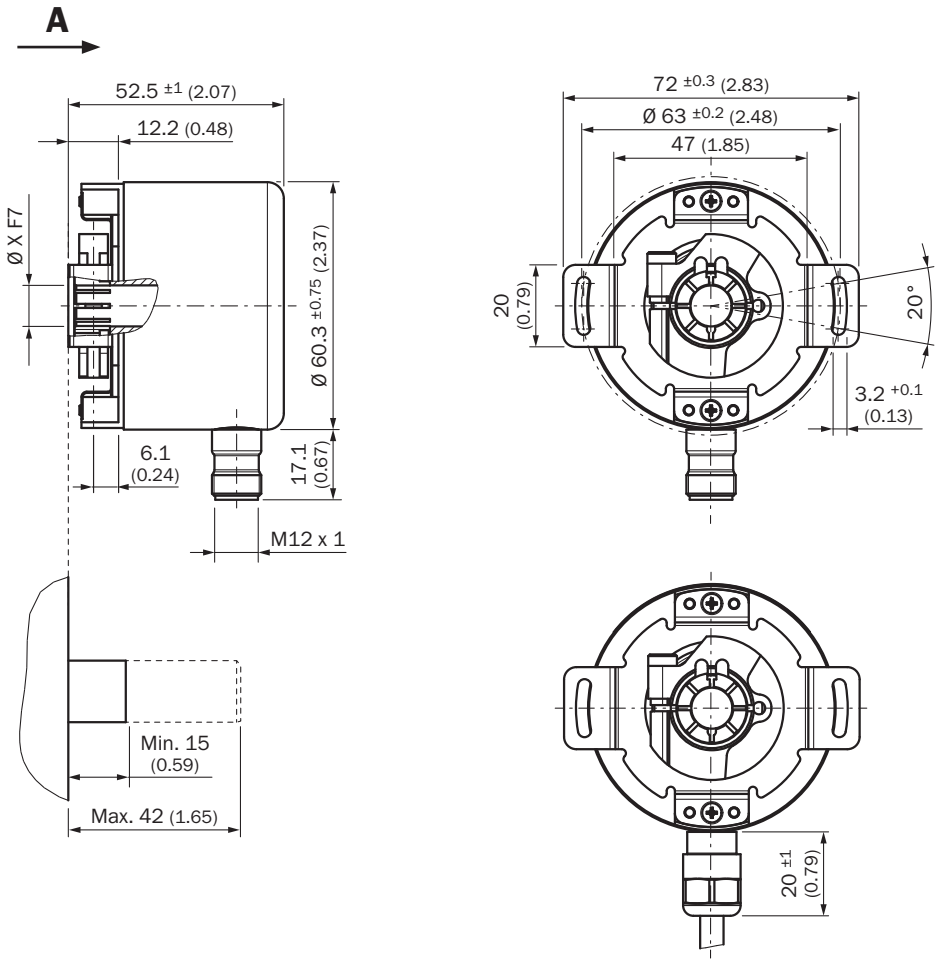
[1] EMC according to the standards quoted is achieved if shielded cables are used.
[2] With mating connector fitted.
[3] Stationary position of the cable.
[4] Flexible position of the cable.

Classifications

ECl@ss 5.0	27270502
ECl@ss 5.1.4	27270502
ECl@ss 6.0	27270590
ECl@ss 6.2	27270590
ECl@ss 7.0	27270502
ECl@ss 8.0	27270502
ECl@ss 8.1	27270502
ECl@ss 9.0	27270502
ECl@ss 10.0	27270502
ECl@ss 11.0	27270502
ETIM 5.0	EC001486
ETIM 6.0	EC001486
ETIM 7.0	EC001486
UNSPSC 16.0901	41112113

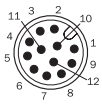
Dimensional drawing (Dimensions in mm (inch))

Blind hollow shaft



PIN assignment

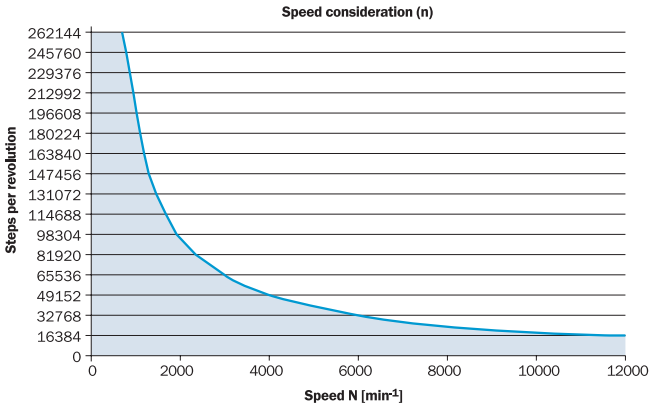
M12 male connector, 12-pin and cable connection, cable 12-wire, SSI/Gray + incremental



View to the connector M12 12-pin fitted to the encoder body

PIN, 12-pin, M12 connector	Color of wires, cable outlet	Signal	Explanation
1	Orange/black	CW/$\overline{\text{CCW}}$	Counting sequence when turning
2	White	Data+	Interface signals
3	Brown	Data–	Interface signals
4	Violet	Clock–	Interface signals
5	Red	$+U_s$	Supply voltage
6	Gray	A	Signal line
7	Green	$\overline{\text{A}}$	Signal line
8	Pink	B	Signal line
9	Black	$\overline{\text{B}}$	Signal line
10	Orange	SET	Electronic adjustment
11	Yellow	Clock+	Interface signals
12	Blue	GND	Ground connection
		Screen	Screen connected to housing on side of encoder. Connected to ground on side of control.

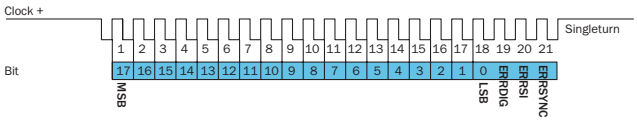
Maximum revolution range



The maximum speed is also dependent on the shaft type.

Diagrams

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.

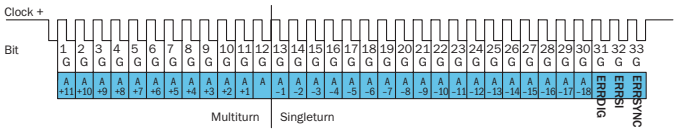
The provided error bits don't have to be used by the PLC compulsorily.

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.

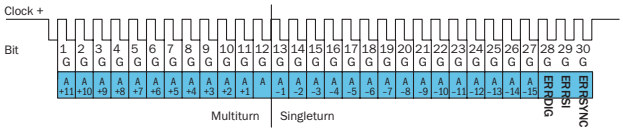
SSI data format multiturn

30 Bits



Bit 1–12: Position Bits multiturn
Bit 13–30: Position Bits singleturn
Bit 31–33: Error Bits

27 Bits



Bit 1–12: Position Bits multiturn
Bit 13–27: Position Bits singleturn
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.
- 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. The multiturn resolution is fixed on 12 bits.

Example

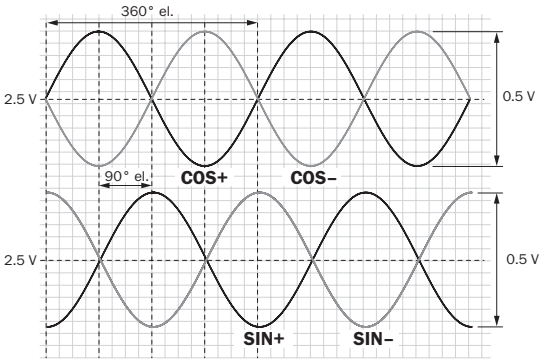
If the resolution of the absolute encoder is set on 27 bits, 30 bits are provided by the encoder: 27 data bits and 3 error bits.
If the PLC is not able to evaluate the error bits, the PLC has to be set on a resolution of 27 bits. Then the error bits have to be masked out by the PLC.

Electrical interfaces sine 0.5 V_{pp}

Power supply	Output
4.5 ... 5.5 V	Sine 0.5 V_{pp}

Signal **before** differential generation at load 120 Ω at U_S = 5 V

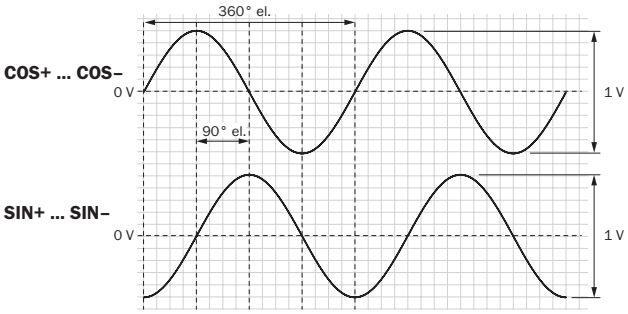
Signal diagram for clockwise rotation of the shaft looking in direction "A" (shaft)



Interface signals Sin, $\overline{\text{Sin}}$, Cos, $\overline{\text{Cos}}$	Signal before differential generation at load 120 Ω	Signal offset
Analog differential	0.5 V_{pp} ± 20 %	2.5 V ± 10 %

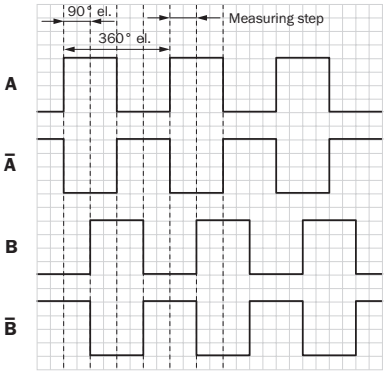
Signal **after** differential generation at load 120 Ω at U_S = 5 V

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



Electrical interfaces HTL/TTL

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



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