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DATA SHEET

AFS60S-TCSM262144

AFS/AFM60S Pro
Safety encoders

SICK Sensor Intelligence



Illustration may differ

SAFETY ENCODERS

AFS60S-TCSM262144

ORDERING INFORMATION

Type	part no.
AFS60S-TCSM262144	On request

Further device versions and accessories at www.sick.com/AFS_AFM60S_Pro

DETAILED TECHNICAL DATA

SAFETY-RELATED PARAMETERS

Safety integrity level	SIL 3 (IEC 61508, IEC 61800-5-3) [1]
Performance level	PL e (EN ISO 13849-1) [1]
Category	3 (EN ISO 13849-1) 4 (EN ISO 13849-1)
PFH (mean probability of a dangerous failure per hour)	5.5×10^{-9} at 40 °C [2] 1.8×10^{-8} at 80 °C [2]
T_M (mission time)	20 years (EN ISO 13849-1) [3]
Safety-related accuracy	0.09° category 3 [4] 0.35° category 4 [4]

[1] For more detailed information on the exact configuration of your machine/unit, please consult your relevant SICK branch office.

[2] The values displayed apply to a the temperature at the operating temperature measuring point and diagnostic degree of coverage of 99%, which must be achieved by the external evaluation unit.

[3] Depending on the application, the operating life may also be limited by the bearing lifetime.

[4] The safety-related accuracy indicates the maximum positioning error limit with which the safety functions can be supported.

PERFORMANCE

Number of steps per revolution (max. resolution)	262,144 (18 bit)
Error limits G	0.05° [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 + Sin/Cos
Initialization time	2 s [1]
Position forming time	< 1 µs
Parameterising data	Number of steps per revolution Preset position, preset position via hardware pin, counting direction, counting direction via hardware pin, reset factory setting, read out error memory, generate report
Code type	Gray
Code sequence parameter adjustable	CW/CCW configurable [2]
Clock frequency	100 kHz, ≤ 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)
Sine/cosine periods per revolution	1,024
Output frequency	≤ 153.6 kHz
Load resistance	≥ 120 Ω
Signal before differential generation	0.5 V_{pp}, ± 20 %
Signal offset before differential generation	2.5 V ± 10 %
Signal after differential generation	1 V_{pp}, ± 20 %

[1] Valid signals can be read once this time has elapsed.

[2] Set on tool side: CW with view to the shaft.

ELECTRONICS

Connection type	Cable, 12-wire, radial, 5 m
Supply voltage	4.5 ... 32 V
Power consumption	0.7 W (without load)
Reverse polarity protection	✓
Short-circuit protection	✓ [1]

[1] SinCos interface: Short-circuit to another channel or GND permitted for max. 30 sec. In the case of U_s ≤ 12 V additional short-circuit to U_s permitted for max. 30 sec.

SSI interface: Short-circuit to another channel or GND permitted for max. 30 s. In the case of U_s ≤ 5 V, additional short-circuit to U_s permitted for max. 30 s.

MECHANICS

Mechanical design	Through hollow shaft
Shaft diameter	3/8" [1]
Characteristics of the shaft	With feather key groove
Weight	0.25 kg [2]
Shaft material	Stainless steel
Flange material	Die-cast zinc
Material, stator coupling	Stainless steel
Housing material	Aluminum die cast
Start up torque	≤ 0.8 Ncm (+20 °C)
Operating torque	≤ 0.6 Ncm (+20 °C)
Permissible movement static	± 0.3 mm (radial) ± 0.5 mm (axial)

[1] With feather key groove.

[2] Based on devices with male connector.

[3] Depending on the application, the operating life may also be limited by the bearing lifetime.

[4] The value corresponds to L_{10mv} (ISO/TS 16281) at 10 °C up to 60 °C operating temperature, speed > 10 U/min, at max. permitted shaft load / shaft movement.

Permissible movement dynamic	± 0.05 mm (radial) ± 0.1 mm (axial)
Operating speed	≤ 6,000 min^{-1}
Moment of inertia of the rotor	56 gcm^2
Bearing lifetime	3.6 x 10^9 revolutions [3) 4)]

[1)] With feather key groove.

[2)] Based on devices with male connector.

[3)] Depending on the application, the operating life may also be limited by the bearing lifetime.

[4)] The value corresponds to L_{10mr} (ISO/TS 16281) at 10 °C up to 60 °C operating temperature, speed > 10 U/min, at max. permitted shaft load / shaft movement.

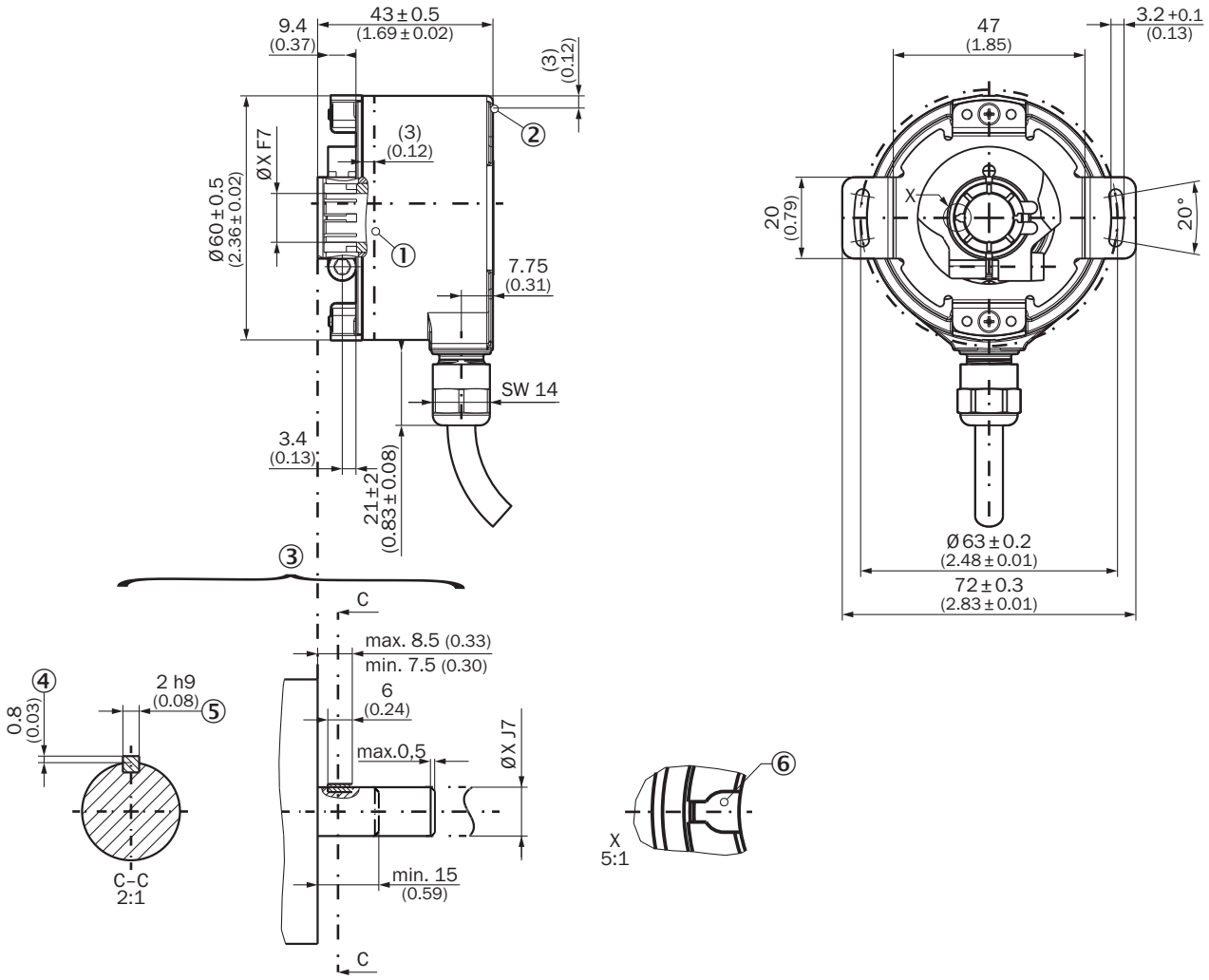
AMBIENT DATA

EMC	EN 61000-6-2 EN 61000-6-3 EN 61000-6-7
Enclosure rating	IP65 (IEC 60529)
Permissible relative humidity	90 % (Condensation not permitted)
Operating temperature range	–30 °C ... +85 °C [1)]
Storage temperature range	–30 °C ... +85 °C, without package
Resistance to shocks	100 g, 6 ms (according to EN 60068-2-27) [2)]
Resistance to vibration	18 g, 10 Hz ... 1,000 Hz (EN 60068-2-6) [2)]
Operating height (above sea level)	≤ 2,000 m (80 kPa)
Protection class	III (according to DIN EN 61140)
Contamination rating	2 (IEC 60664-1)

[1)] At operating temperature measuring point.

[2)] Tested during operation within the safety-related accuracy.

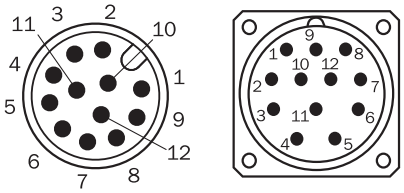
DIMENSIONAL DRAWING THROUGH HOLLOW SHAFT, RADIAL CABLE



Dimensions in mm (inch)
General tolerances according to DIN ISO 2768-mk
① operating temperature measuring point (freely selectable, around the housing surface area in each case, approx. 3 mm away from flange)
② measuring point vibration (respectively at the housing face. approx. 3 mm away from the cover edge)
③ Attachment specifications
④ feather key DIN 6885-A 2x2x6
⑤ max. 0.4 at Ø 5/8"
⑥ feather key groove

Shaft diameter XF7	Shaft diameter xj7
6 mm	Provided by customer
8 mm	
3/8″	
10 mm	
12 mm	
1/2″	
14 mm	
15 mm	
5/8″	

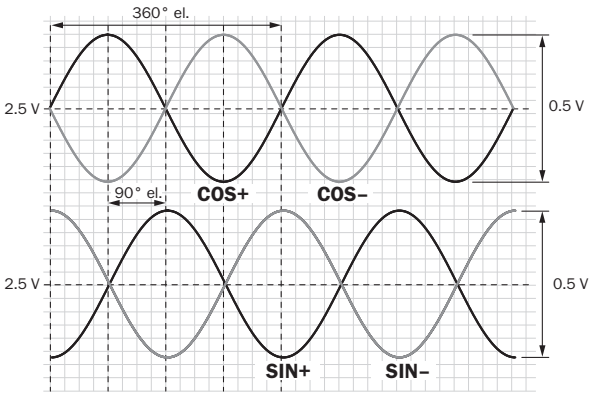
ANSCHLUSSBELEGUNG



View of M23 and M12 male device connector on encoder

PIN (M23)	PIN (M12)	Wire colors (cable connection)	Signal	Explanation
1	5	Red	U_s	Operating voltage
2	12	Blue	GND	Ground connection
3	11	Yellow	Clock +	Interface signals
4	2	White	Data +	Interface signals
5	10	Orange	SET	Electronic adjustment
6	3	Brown	Data -	Interface signals
7	4	Violet	Clock -	Interface signals
8	9	Black	- SIN	Signal cable
9	1	Orange-black	CW/CCW (V/R)	Sequence in direction of rotation
10	7	Green	- COS	Signal cable
11	6	Gray	+ COS	Signal cable
12	8	Pink	+ SIN	Signal cable
–	–	–	Shielding	Shielding connected to housing on encoder side. Connected to ground on control side.

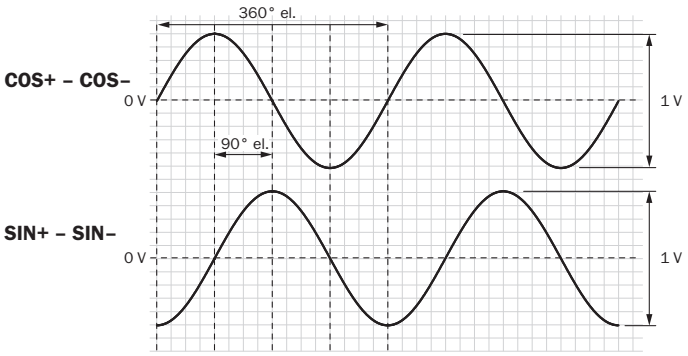
DIAGRAMS SIGNAL SIN/COS BEFORE DIFFERENTIAL GENERATION



For clockwise shaft rotation, looking in direction “A” (see dimensional drawing)

Signal	Interface signals	Signal before differential generationAt load 120 Ω	Signal offset
+ SIN- SIN+ COS- COS	Analog, differential	0,5 V_{ss} ± 20 %	2,5 V ± 10 %

DIAGRAMS SIGNAL SIN/COS AFTER DIFFERENTIAL GENERATION



For clockwise shaft rotation, looking in direction “A” (see dimensional drawing)

Supply voltage	Output
4,5 V ... 5,5 V	Sin/Cos 1.0 V_{PP}

Further information as well as suitable accessories, example applications and downloads such as CAD dimensional models, operating instructions and software can be found at www.sick.com/AFS/AFM60S Pro

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SICK AT A GLANCE

SICK is a leading global technology company for intelligent sensors and integrated solutions in industrial automation. Our technologies set benchmarks, making your industrial processes more efficient, safer and more sustainable – both in logistics and manufacturing operations.

SICK combines sensor intelligence with industry expertise and certified consulting services. We provide the ideal foundation for scalable as well as tailor-made automation solutions and create added value along the entire value chain. Our close partnerships with our customers are more than just a promise: Together, we optimize productivity, improve quality, protect health and safety, and help build a sustainable future. All with empathy and trust.

Since 1946, we have been developing innovative technologies with passion and a pioneering spirit. With a global network in around 40 countries, SICK has a global presence and is always close by. The company's headquarters are located in Waldkirch near Freiburg, Germany. Our customers benefit from our understanding of both local and global requirements, which enables us to deliver tailor-made solutions

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