

# AFS60B-THPA032768

AFS/AFM60 SSI

**ABSOLUTE ENCODERS**

**SICK**  
Sensor Intelligence.

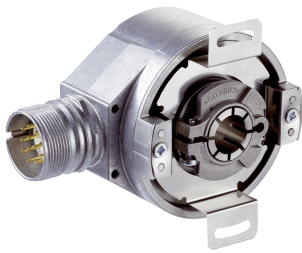


Illustration may differ



## Ordering information

Type	Part no.
AFS60B-THPA032768	1052259

Other models and accessories → [www.sick.com/AFS\\_AFM60\\_SSI](http://www.sick.com/AFS_AFM60_SSI)

## Detailed technical data

### Performance

<b>Number of steps per revolution</b>	32,768 (max.) <sup>1)</sup>
<b>Number of revolutions</b>	1 (max.)
<b>Max. resolution (singleturn, multiturn)</b>	32,768 (15 bit), 1 (0 bit)
<b>Error limits G</b>	0.05° <sup>2)</sup>
<b>Repeatability standard deviation <math>\sigma_r</math></b>	0.002° <sup>3)</sup>

<sup>1)</sup> See maximum revolution range.

<sup>2)</sup> 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.

<sup>3)</sup> In accordance with DIN ISO 55350-13; 68.3% of the measured values are inside the specified area.

### Interfaces

<b>Communication interface</b>	SSI
<b>Initialization time</b>	50 ms <sup>1)</sup>
<b>Position forming time</b>	< 1 µs
<b>SSI</b>	
Code type	Gray Programmable
Code sequence parameter adjustable	CW/CCW parameter adjustable
Clock frequency	≤ 2 MHz <sup>2)</sup>
Set (electronic adjustment)	H-active (L = 0 - 3 V, H = 4,0 - Us V)
CW/CCW (counting sequence when turning)	L-active (L = 0 - 1,5 V, H = 2,0 - Us V)
<b>Incremental</b>	
Load current	≤ 30 mA

<sup>1)</sup> Valid positional data can be read once this time has elapsed.

<sup>2)</sup> Minimum, LOW level (Clock +): 500 ns.

### Electrical data

<b>Connection type</b>	Male connector, M23, 12-pin, radial
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<sup>1)</sup> 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.

<b>Supply voltage range</b>	4.5 V DC ... 32 V DC
<b>Power consumption</b>	0.5 W (without load)
<b>Reverse polarity protection</b>	✓
<b>MTTFd: mean time to dangerous failure</b>	250 years (EN ISO 13849-1) <sup>1)</sup>

<sup>1)</sup> 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

<b>Mechanical feature</b>	Through hollow shaft
<b>Shaft diameter</b>	15 mm
<b>Weight</b>	0.2 kg <sup>1)</sup>
<b>Shaft material</b>	Stainless steel
<b>Flange material</b>	Aluminum
<b>Housing material</b>	Aluminum die cast
<b>Start up torque</b>	< 0.8 Ncm <sup>2)</sup>
<b>Operating torque</b>	< 0.6 Ncm <sup>2)</sup>
<b>Permissible movement static</b>	± 0.5 mm (axial) ± 0.3 mm (radial)
<b>Permissible movement dynamic</b>	± 0.2 mm (axial) ± 0.1 mm (radial)
<b>Moment of inertia of the rotor</b>	40 gcm <sup>2</sup>
<b>Bearing lifetime</b>	3.0 x 10 <sup>9</sup> revolutions
<b>Angular acceleration</b>	+ 500,000 rad/s <sup>2</sup>
<b>Operating speed</b>	≤ 9,000 min <sup>-1</sup>

<sup>1)</sup> Relates to devices with male connector connection.

<sup>2)</sup> At 20 °C.

## Ambient data

<b>EMC</b>	According to EN 61000-6-2 and EN 61000-6-3 <sup>1)</sup>
<b>Enclosure rating</b>	IP65, shaft side (according to IEC 60529) IP67, housing side (according to IEC 60529) <sup>2)</sup>
<b>Permissible relative humidity</b>	90 % (condensation of the optical scanning not permitted)
<b>Operating temperature range</b>	-40 °C ... +100 °C <sup>3)</sup>
<b>Storage temperature range</b>	-40 °C ... +100 °C, without package
<b>Resistance to shocks</b>	70 g, 6 ms (according to EN 60068-2-27)
<b>Resistance to vibration</b>	30 g, 10 Hz ... 2,000 Hz (according to EN 60068-2-6)

<sup>1)</sup> EMC according to the standards quoted is achieved if shielded cables are used.

<sup>2)</sup> With mating connector fitted.

<sup>3)</sup> Stationary position of the cable.

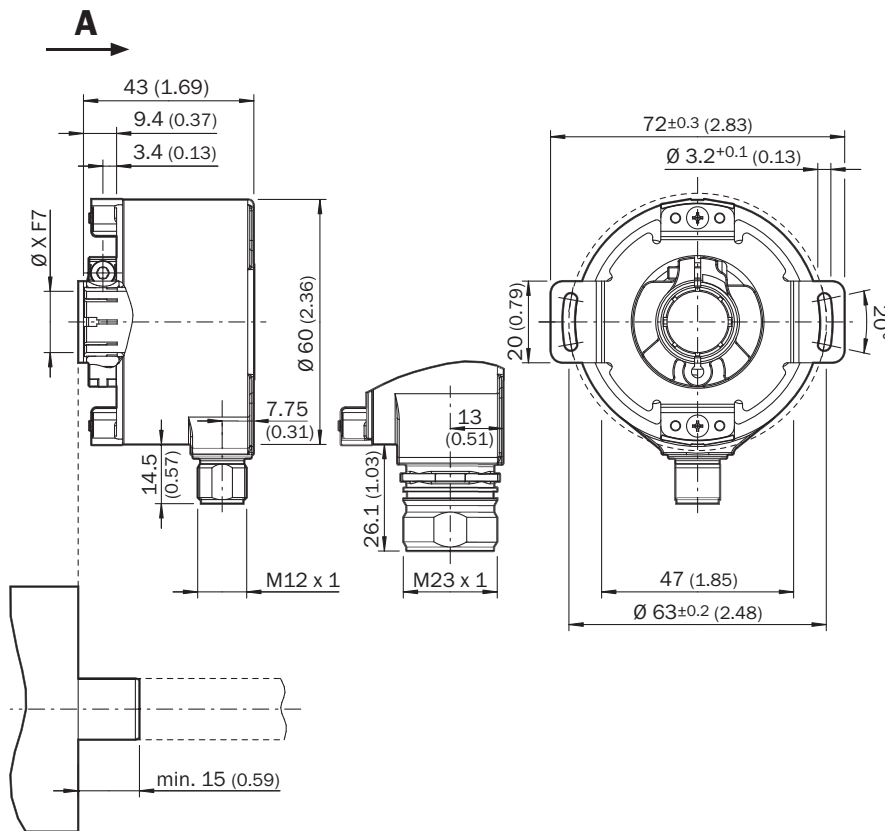
## Classifications

<b>ECl@ss 5.0</b>	27270502
<b>ECl@ss 5.1.4</b>	27270502
<b>ECl@ss 6.0</b>	27270590

<b>ECI@ss 6.2</b>	27270590
<b>ECI@ss 7.0</b>	27270502
<b>ECI@ss 8.0</b>	27270502
<b>ECI@ss 8.1</b>	27270502
<b>ECI@ss 9.0</b>	27270502
<b>ETIM 5.0</b>	EC001486
<b>ETIM 6.0</b>	EC001486
<b>UNSPSC 16.0901</b>	41112113

### Dimensional drawing (Dimensions in mm (inch))

Through hollow shaft, radial plug connection M12 and M23

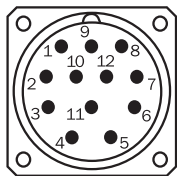


General tolerances according to DIN ISO 2768-mk

① Cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

## PIN assignment

View of the M23 male connector plug-in face



Connector M23, 12-pin  
SSI/Gray

Pin	Signal	Explanation
1	GND	Ground 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 <sub>s</sub>	Supply voltage
9	SET	Electronic adjustment
10	Data-	Interface signals
11	Clock-	Interface signals
12	CW/CCW	Counting sequence when turning
	Screen	Screen on the encoder side connected to the housing. On the control side connected to earth.

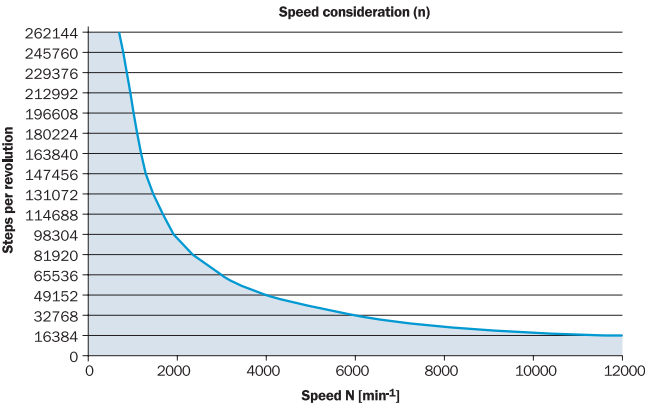
Connector M23, 12-pin and cable outlet, cable 12-core  
SSI/Gray + Incremental

Pin	Color wires	Signal	Explanation
1	Red	+U <sub>s</sub>	Supply voltage
2	Blue	GND	Ground connection
3	Yellow	Clock+	Interface signal
4	White	Data+	Interface signal
5	Orange	SET	Electronic adjustment
6	Brown	Data-	Interface signal
7	Violet	Clock-	Interface signal
8	Black	~ B	Signal line
9	Orange/black	CW/CCW	Counting sequence when turning
10	Green	~ A	Signal line
11	Gray	A	Signal line
12	Pink	B	Signal line
		Screen	Screen on the encoder side connected to the housing. On the control side connected to earth.

Connector M23, 12-pin and cable outlet, cable 12-core  
SSI/Gray + Sin/Cos

Pin	Color wires	Signal	Explanation
1	Red	+U <sub>s</sub>	Supply voltage
2	Blue	GND	Ground connection
3	Yellow	Clock+	Interface signal
4	White	Data+	Interface signal
5	Orange	SET	Electronic adjustment
6	Brown	Data-	Interface signal
7	Violet	Clock-	Interface signal
8	Black	Sin-	Signal line
9	Orange/black	CW/CCW	Counting sequence when turning
10	Green	Cos-	Signal line
11	Gray	Cos+	Signal line
12	Pink	Sin+	Signal line
		Screen	Screen on the encoder side connected to the housing. On the control side connected to earth.

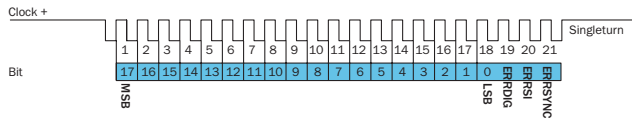
Maximum revolution range



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.

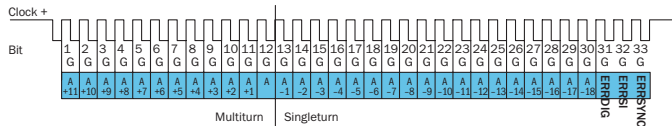
The provided error bits don't have to be used by the PLC compulsorily.

#### 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.

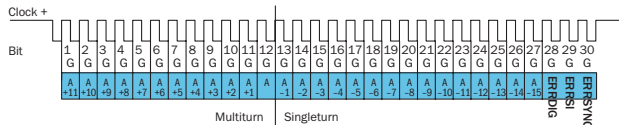
### SSI data format multiturn

#### 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

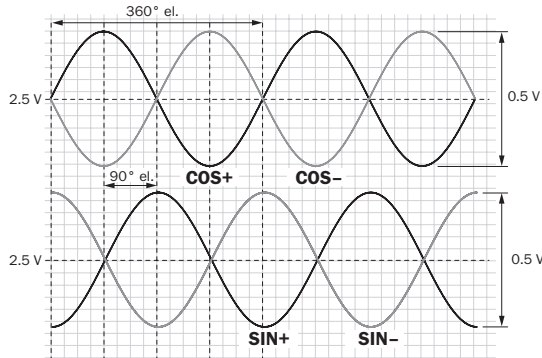
If the resolution of the absolute encoder is set on 27 bits, 30 bits are provided by the encoder: 27 data bits and 3 error bits. If the PLC is not able to evaluate the error bits, the PLC has to be set on a resolution of 27 bits. Then the error bits have to be masked out by the PLC.

### 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  $120 \Omega$  at  $U_s = 5 V$

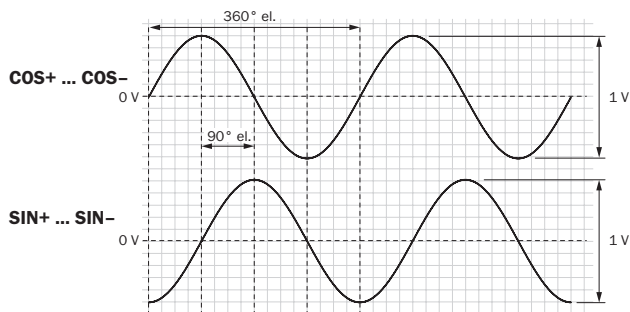
Signal diagram for clockwise rotation of the shaft looking in direction "A" (shaft)



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

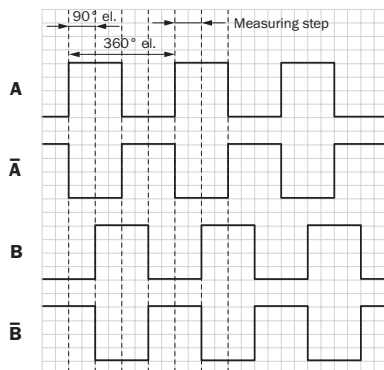
Signal **after** differential generation at load  $120 \Omega$  at  $U_s = 5 V$

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





## Recommended accessories

Other models and accessories → [www.sick.com/AFS\\_AFM60\\_SSI](http://www.sick.com/AFS_AFM60_SSI)

	Brief description	Type	Part no.
Programming and configuration tools			
	USB programming unit, for programmable SICK encoders AFS60, AFM60, DFS60, VFS60, DFV60 and wire draw encoders with programmable encoders	PGT-08-S	1036616
	Programming unit display for programmable SICK DFS60, DFV60, AFS/AFM60, AHS/AHM36 encoders, and wire draw encoder with DFS60, AFS/AFM60 and AHS/AHM36. Compact dimensions, low weight, and intuitive operation.	PGT-10-Pro	1072254

## SICK AT A GLANCE

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We have extensive experience in a wide range of industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services complete our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

For us, that is “Sensor Intelligence.”

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