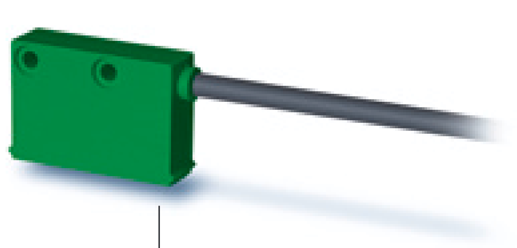
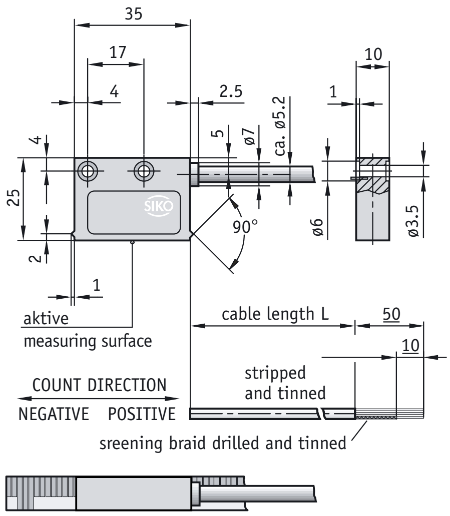
Magnetic sensor MSK210

As a component of a magnetically operating, open and robust measuring system, this sensor has integrated interpreting electronics and a direct, digital signal output. Used in conjunction with the magnetic rings MR200 the sensor forms an open and robust rotary encoder system with high resolutions.





Array sensor / ring for reference signal R

Features:

- insensitive to dust, shavings, humidity
- max. resolution 0.045°, system accuracy ± 0.1°
- real-time data processing
- rotary encoder system with IP67 protection class (MR200)
- fixed index signals

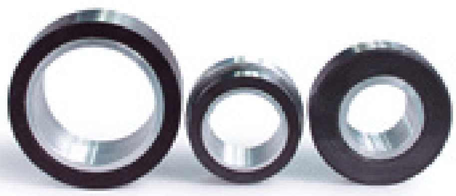
Note: For supply voltage 4 and output circuit LD it is necessary to use a terminating resister of ≥ 470 Ohm to prevent thermal stress.

Feature	Ordering data		Technical data	Additional information
Supply voltage	**4**	A	**24 V DC ± 20 %**	**standard, with polarity protection**
	5		5 V DC ± 5 %	
Design	**A**	B		**standard**
Connection / cable length	**E1/2.0**	C	**2 m cable, flying leads**	**standard** (cable length max. 20 m)
	E6, E8		E6, circular plug	E8, D-SUB 9 pins
Output circuit	**PP**	D	**push pull**	**standard**
	LD		line driver	
	TTL			only with non-inverted output signal (cable length max. 5 m)
Output signal	**NI**	E	**not inverted**	**standard**
	I		inverted	
Reference signal	**0**	F	**without**	**standard**
	I		index periodical	
	R		index fixed	
Scaling factor	**20**	G	**factor 20**	**standard**, option 16/10/8/5/4/1
Power consumption			max. 70 mA	@ 24 V DC unloaded
Output signals			A,B	quadrature signal
			A, /A, B, /B, option: I, /I, or R, /R	only design A, quadrature signal
Gap ring/ sensor			0.1 – 0.8 mm, Reference signal R < 0.4 mm	lateral offset ± 1 mm, angular offset ± 3°
System accuracy			± 0.1°	repeat accuracy ± 1 increment
Jitter			< 15%	for sensor/strip gap 0,5 mm
Travel speed			max. 25 m/s	max. reference speed 2.0 m/s
Interference protection class			3, acc. to IEC 801	humidity: 100 % rF, condensation permissible
Temperature ranges			working temperature: -10° ... + 70 °C	storage temperature: -30 ... + 80 °C
Protection class			IP67 acc. to DIN 40050 (casing)	test mark: CE
Housing			A - plastic green, L - aluminium green	
Cable			PUR	

Your ordering: MSK210 – A – B – C – D – E – F – G

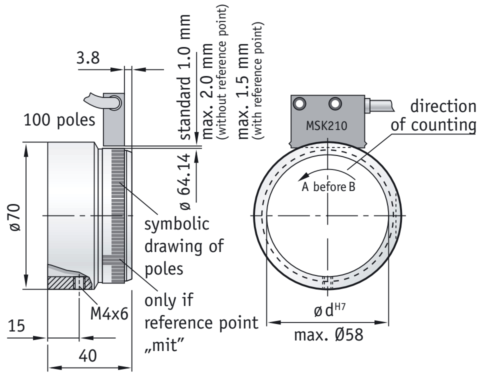
Magnetic ring MR200

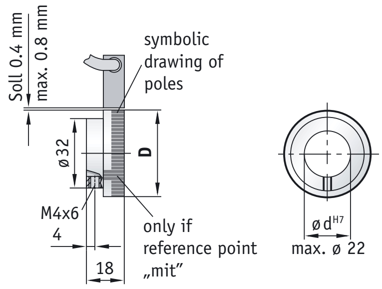
A ferrite ring, permanently attached to a turned aluminium ring serves as the basis for magnetically applied encoding with defined spacing. The ring as the physical measure forms together with the MSK210 sensor a robust measuring system for angle and rotational speed acquisition.



Features:

- easy hollow shaft installation
- insensitive to dust, shavings, humidity, liquids and oil
- rotary encoder system with IP67 type of protection (in combination with MSK210)
- up to 2000 pulses/revolution
- index signal





poles	50	64
D	ø32.3	41.2

Feature	Ordering data	Technical data	Additional information
Pole number	**50** A	distributed to circumfer	**standard**, ø ~32,3 mm / circumference = 0.1 m, ferrit
	64	distributed to circumfer	ø ~41,2 mm / circumference = 0.13 m, ferrit
	100	distributed to circumfer	ø ~64,14 mm / circumference = 0.2 m, flexible magnetic band
bore D^{H7}	**20** B	20^{H7}	**standard**, other on request
Befestigungsart	**MNG** C	hub thread	**standard**
Referenzpunkt	**ohne** D	without	**standard**
	mit	with	
Impulse/turn		see appendix	
Gap sensor / magnetic ring		see drawing	
System accucracy		±0.1°	
Flange material		aluminium	
Operating temperature		0 … +60 °C	others on request
Storage temperature		-20 … +70 °C	others on request
Air humidity		100 % rF, condensation permitted	
Max. rotational speed		calculation: see appendix	

Your ordering: MR200 – [ ] A – [ ] B – [ ] C – [ ] D

Appendix: Output circuits, Signal illustration

MSK210/MSK320 version A

Output signal A / B
Output circuit TTL

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	AM26C31	> 4.5 V	< 0.15 V	5 mA
5 V	AM26C31	> 4.5 V	< 0.15 V	5 mA

Output signal A / B and I inverted
Output circuit PP

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	OL7272	> U_B - 0.8 V	< 0.5 V	50 mA

Output signal A / B and I inverted
Output circuit LD; 120 ohm connection

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	AM26C31	RS422 spec.	RS422 spec.	R_{last} > 470 Ohm
5 V	AM26C31	RS422 spec.	RS422 spec.	RS422 spec.

MSK320 version F

Output signal A / B
Output circuit PP not short-circuit proof

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	transistor	> U_B - 1 V	< 0.15 V	50 mA

Output signal A / B
Output circuit TTL

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	74HC04	> 4.5 V	< 0.15 V	5 mA
5 V	74HC04	> 4.5 V	< 0.15 V	5 mA

MSK500/1

Output signal A / B and I inverted
Output circuit PP

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	OL7272	> U_B - 0.8 V	< 0.5 V	50 mA

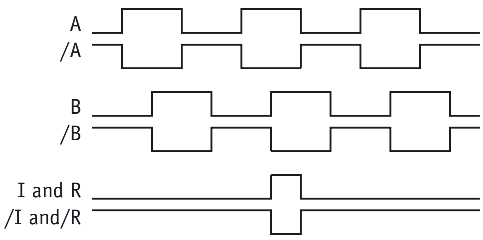
Output signal A / B and I inverted
Output circuit LD; 120 ohm connection

Power supply	Output driver	U_{HIGH} (unloaded)	U_{LOW} (unloaded)	I_{max}/channel
24 V	AM26C31	RS422 spec.	RS422 spec.	R_{last} > 470 Ohm
5 V	AM26C31	RS422 spec.	RS422 spec.	RS422 spec.

Signal illustration

Note: position of the index signals I/R in regards to signals A and B is not defined with sensor MSK500/1.

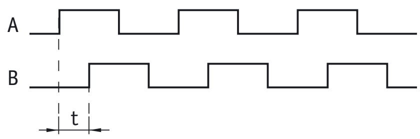
with index-, reference- and inverted signals



Pulse interval

The pulse distance "t" is the shortest time period which can occur between two signal edges when moving the magnetic sensor. Micro vibration can trigger it for example. It must be made sure that the follower electronics is able to correctly process the signals.

pulse interval



Example: pulse interval t = 1 µs

$$\text{input frequency} = \frac{1}{1\ \mu s \cdot 4} = 250\ \text{kHz}$$

The follower electronics must be able to work with 250 kHz.

Appendix: Calculation tables

Impulses/turn

The calculation of the impulses/turn is dependent on the number of poles and the scaling factor and is calculated with the formula:

impulses/turn = Scaling factor x pole pitch

MR320 and MSK320

Impulses/turn				Scaling factor
2000	3000	3600	5000	20
1600	2400	2880	4000	16
1000	1500	1800	2500	10
800	1200	1440	2000	8
500	750	900	1250	5
400	600	720	1000	4
100	150	180	250	1
100	150	180	250	pole pitch

MRI01 and MSK320

Impulses/turn	Scaling factor
1280	20
1024	16
640	10
512	8
320	5
256	4
64	1
64	pole pitch

MR200 and MSK210

Impulses/turn			Scaling factor
1000	1280	2000	20
800	1024	1600	16
500	640	1000	10
400	512	800	8
250	320	500	5
200	256	400	4
50	64	100	1
50	64	100	pole pitch

MR500 and MSK500/1

Impulses/turn			Scaling factor
16000	24000	40000	250
8000	12000	20000	125
6400	9600	16000	100
4000	6000	10000	62.5
3200	4800	8000	50
1600	2400	4000	25
800	1200	2000	12.5
64	96	160	pole pitch

Rotational Speed

The calculation of the maximum rotational speed takes place with respect to the circumferential speed where the circumference of the magnetic ring used is decisive. For the MSK320 sensor, the circumferential speed is 25 m/s whereas the speed for the MSK500/1 sensor is variable and results from the selection of the pulse interval and the scaling factor (see MSK500/1 table).
The rotational speed is calculated with the formula:

$$\text{rotational speed } n = \frac{v \cdot 60}{U}$$

v = circumferential speed [m/s]; U = circumference[m]
60 = expansion factor [60 s/min]

MSK320 for instance: $n = \frac{25 \cdot 60}{0.32} = 4687.50$ [1/min]

MSK500/1 for instance: $n = \frac{6 \cdot 60}{0.32} = 1125$ [1/min]

MR200

Pole pitch	U [m]	n [1/min]
50	0.1	15 000
64	0.13	11 500
100	0.2	7 500

MR320

Pole pitch	U [m]	n [1/min]
100	0.32	4687.50
150	0.48	3125.00
180	0.57	2631.00
250	0.80	1875.00

MRI01

Pole pitch	U [m]	n [1/min]
64	0.157	9554.14

MR500

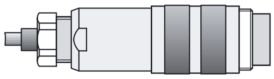
Pole pitch	U [m]	n [1/min]
64	0.32	variable
96	0.48	variable
160	0.80	variable

Appendix/Pin outs

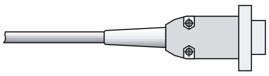
MSK210 + MSK320 + MSK500

Connection type E1

Connection type E6



Connection type E8



Signals not inverted (only MSK320)

PIN (E8)	PIN (E6)	Color (E1)	Signal
1	1	black	GND
2	2	brown	+UB
3	3	red	A
4	4	orange	B

Signals inverted

PIN (E8)	PIN (E6)	Color (E1)	Signal
1	1	red	A
2	2	orange	B
3	3	–	N.C.
4	4	brown	+UB
5	5	black	GND
6	6	yellow	A/
7	7	green	B/

Signals inverted with reference signal

PIN (E8)	PIN (E6)	Color (E1)	Signal
1	1 (A)	red	A
2	2 (B)	orange	B
3	3 (C)	blue	I
4	4 (D)	brown	+UB
5	5 (E)	black	GND
6	6 (F)	yellow	A/
7	7 (G)	green	B/
8	8 (H)	violet	I/