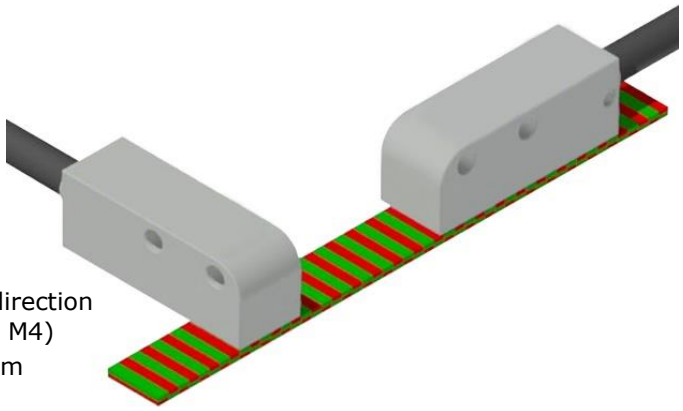
Datasheet

Incremental miniature magnetic sensor for installation in transverse or longitudinal direction

- Small design: 12 x 13 x 35 mm
- Aluminium housing
- Resolution up to 0,5 µm; hysteresis ± 1µm
- Pole pitch: 1 or 2 mm
- Output signal: Digital (TTL-RS422) or analog (1 Vpp)
- Direct connection to control / display
- Issue of reference and index signals
- Easy mounting in transverse or longitudinal direction to the magnetic tape (through hole or thread M4)
- Distance sensor - Magnetic scale up to 1,2 mm
- Movement speed up to 20 m/s
- IP-rating: IP67



Mechanical characteristics

Dimension	12 x 13 x 35 mm	
Material Housing Cable	 Aluminium PUR	
Weight Sensor	 approx. 14 g	
System Accuracy	max. ±5 µm	
	EHP1 and EHP1/90	**EHP2 and EHP2/90**
Resolution (TTL-Variant)	10 µm / 5 µm / 2 µm / 1 µm / 0.5 µm	20 µm / 10 µm / 5 µm/ 2 µm / 1 µm – further on request
Interpolation accuracy	typ. ± 1.5 µm < ± 2 µm	typ. ± 3.5 µm < ± 4 µm
Fitting magnetic scale	PM1	PM2
Wavelength	λ= 1 mm	λ= 2 mm
Sensor - Magnetic scale [1)] without cover tape with cover tape	 0.01 up to 0.35 mm max. 0.2 mm	 0.01 up to 1.2 mm max. 1.1 mm
Movement speed digital analog	 the max. travel speed is related to the resolution and edge separation (see table) max. 10 m/s	
Operating temperature	-20 °C up to +80 °C	
Humidity	<90% not condensing	
Cable	8-wire cable; twisted pair and shielded	
Connector	open cable end (standard); optional Sub-D, 9-pole or M12, 8-pole further connectors on request	
Shock rating EN 60068-2-27	100 g/ 6 ms	
Continuous shock EN 60068-2-29	100 g/ 2 ms	
Vibration load EN 60068-2-6	12 g, 10 … 2.000 Hz	
IP-Rating	IP67	

[1)] The subsequent electronics (control; display) has the edge distance of at least 120 ns (= 0.12 µm) can safely count on optimal performance. (Note counting frequency of the controller!)

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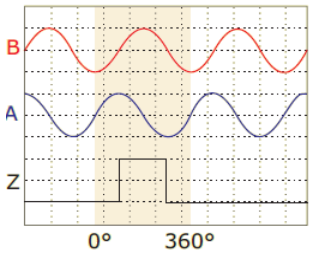
Electrical characteristics

Power supply		5V ±5%	
Consumption (without circuitry of subsequent electronics)		typ. 35 mA max. 50 mA	
Reference signal		without fix / fix-periodically pole-periodically	
Hysteresis		≤ 2 µm	(distance-dependent)
Linearity deviation by the evaluation		≤ ±2 µm	
External magnetic fields		< 30 mT <1 mT	to permanent damage to avoid not to influence measurement
Analog (sine-cosine signal)		**Vpp**	
Signal level	(A; B;Z)	0.6 Vpp – 1.2 Vpp typ. 1.1 Vpp	
Signal ratio	(A/B)	0.8 – 1.25	
Phase angle		90° ±0.1° el.	
THD [1]		max. 0.1%	EHP1
Signal period	(A; B)	1000 µm 2000 µm	EHP1 EHP2
Digital (square wave signal)		**TTL**	
Signal level		RS422	
Output		Line Driver	
Square wave signal		DIN 66259	
Phase angle	(A-B)	90°	
Terminator		120 Ω	
Edge separation		the edge spacing is related to the resolution and the max. traversing (see table)	

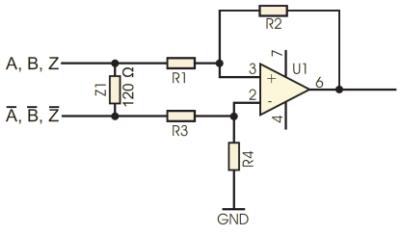
[1] In the variant EHP1 is when using the magnetic scale Permagnet® series no hysteresis (backlash) exists. Connected to the extremely small total harmonic distortion (typ. Max. 0.1%) of the signals, this allows a perfect control performance in highly dynamic positioning processes (e.g. for direct drives).

Output signal

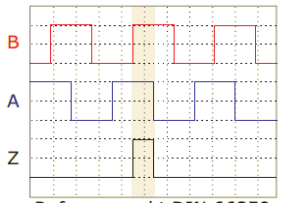
Analog (Vpp)



recommended circuitry of subsequent electronics:



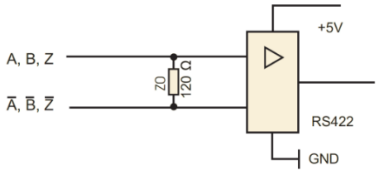
Digital (TTL)



reference point DIN 66259

reference point DIN 66259

recommended circuitry of subsequent electronics:



Electrical connection version W (standard)

For information on other version of the electrical connection, please refer to separate data sheet.

M12; 8-pole

Pin	Colour	Signal				Description
		Analog		Digital		
		Reference function				
		with	without	with	without	
1	white	Z	-	Z	-	Reference signal
2	brown	$\overline{Z}$	-	$\overline{Z}$	-	Reference signal, inverted
3	green	B (+cos)		B		Square wave signal, 90° out of phase with +A cosine voltage signal
4	yellow	$\overline{B}$ (-cos)		$\overline{B}$		Square wave signal, 90° out of phase with +A, inverted cosine-shaped voltage signal, inverted
5	grey	$\overline{A}$ (-sin)		$\overline{A}$		Square wave signal, inverted sinusoidal voltage signal, inverted
6	pink	A (+sin)		A		Square wave signal sinusoidal voltage signal
7	blue	GND				Sensor head ground (0V)
8	red	VCC				Supply voltage 5 V DC
Shield	transparent	PE				PH Shield PE Connector housing/ shield

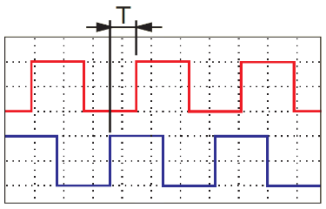
Sub-D; 9-pole

Pin	Colour	Signal				Description
		Analog		Digital		
		Reference function				
		with	without	with	without	
1	brown	$\overline{Z}$	-	$\overline{Z}$	-	Reference signal
2	blue	GND				Ground sensor head (0V)
3		-				
4	yellow	$\overline{B}$ (-cos)		$\overline{B}$		Square wave signal, 90° out of phase with +A, inverted cosine-shaped voltage signal, inverted
5	grey	$\overline{A}$ (-sin)		$\overline{A}$		Square wave signal, inverted sinusoidal voltage signal, inverted
6	pink	A (+sin)		A		Square wave signal sinusoidal voltage signal
7	red	VCC				Supply voltage 5 VDC
8	green	B (+cos)		B		Square-wave signal, 90° out of phase with +A cosine-shaped voltage signal
9	white	Z	-	Z	-	Reference signal

Relationship between edge distance and travel speed

On the basis of two possible methods to explain the tables:

- The determination of a suitable EHPx system with an existing control.
  - ➔ **edge spacing:** min. 1 µs (=1000 ns)
  - ➔ *speed:* max. 2 m/s
  - ➔ **pole pitch**: 1 mm (=EHP1)
    - ⇒ A glance at the table EHP1 enough and you read out of the line at **1000 ns**, the resolution 5 µm as the best possible resolution for this constellation.
- the determination of the required counter frequency, required for the future control.
  - ➔ **resolution**: 1 µm
  - ➔ *speed*: max. 5 m/s
  - ➔ **pole pich**: 1 mm (=EHP1)
    - ⇒ A glance at the table EHP1 enough and you will see that the control of a min. edge separation of 120 ns should (about 8.3 MHz) are safe.



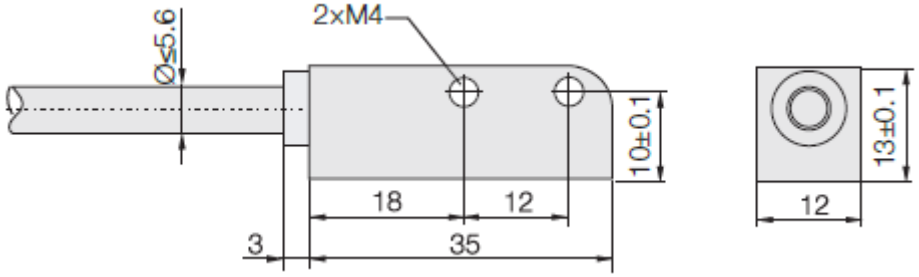
T is the time interval between a signal transition to the next.

Min. Edge separation T		Accord. counter frequency	EHP1 + EHP1/90			
			0,5 µm	1 µm	5 µm	10 µm
0,12 µs	**120 ns**	~ 8,30 MHz	*2,500 m/s*	*5,00 m/s*	*10,00 m/s*	*10,00 m/s*
0,29 µs	**290 ns**	~ 3,40 MHz	*1,000 m/s*	*2,00 m/s*	*10,00 m/s*	*10,00 m/s*
0,48 µs	**480 ns**	~ 2,10 MHz	*0,600 m/s*	*1,20 m/s*	*6,00 m/s*	*6,00 m/s*
0,68 µs	**680 ns**	~ 1,50 MHz	*0,400 m/s*	*0,90 m/s*	*4,50 m/s*	*4,50 m/s*
0,80 µs	**800 ns**	1,25 MHz	*0,400 m/s*	*0,80 m/s*	*4,00 m/s*	*4,00 m/s*
1,00 µs	**1000 ns**	1,00 MHz	*0,250 m/s*	*0,55 m/s*	*2,80 m/s*	*2,80 m/s*
1,50 µs	**1500 ns**	~ 670,00 KHz	*0,200 m/s*	*0,40 m/s*	*2,00 m/s*	*2,00 m/s*
2,00 µs	**2000 ns**	500,00 KHz	*0,150 m/s*	*0,30 m/s*	*1,50 m/s*	*1,50 m/s*
4,00 µs	**4000 ns**	250,00 KHz	*0,075 m/s*	*0,15 m/s*	*0,75 m/s*	*0,75 m/s*
10,00 µs	**10000 ns**	100,00 KHz	*0,030 m/s*	*0,06 m/s*	*0,30 m/s*	*0,30 m/s*

Min. Edge separation T		Accord. counter frequency	EHP2 + EHP2/90			
			1 µm	2 µm	5 µm	10 µm
0,12 µs	**120 ns**	~ 8,30 MHz	*5,00 m/s*	*10,00 m/s*	*10,00 m/s*	*10,0 m/s*
0,29 µs	**290 ns**	~ 3,40 MHz	*2,00 m/s*	*4,00 m/s*	*10,00 m/s*	*10,0 m/s*
0,48 µs	**480 ns**	~ 2,10 MHz	*1,20 m/s*	*2,40 m/s*	*6,00 m/s*	*10,0 m/s*
0,68 µs	**680 ns**	~ 1,50 MHz	*0,80 m/s*	*1,80 m/s*	*4,50 m/s*	*9,0 m/s*
0,80 µs	**800 ns**	1,25 MHz	*0,80 m/s*	*1,60 m/s*	*4,00 m/s*	*8,0 m/s*
1,00 µs	**1000 ns**	1,00 MHz	*0,50 m/s*	*1,20 m/s*	*2,80 m/s*	*5,8 m/s*
1,50 µs	**1500 ns**	~ 670,00 KHz	*0,40 m/s*	*0,80 m/s*	*2,00 m/s*	*4,0 m/s*
2,00 µs	**2000 ns**	500,00 KHz	*0,30 m/s*	*0,60 m/s*	*1,50 m/s*	*3,0 m/s*
4,00 µs	**4000 ns**	250,00 KHz	*0,15 m/s*	*0,30 m/s*	*0,75 m/s*	*1,5 m/s*
10,00 µs	**10000 ns**	100,00 KHz	*0,06 m/s*	*0,12 m/s*	*0,30 m/s*	*0,6 m/s*

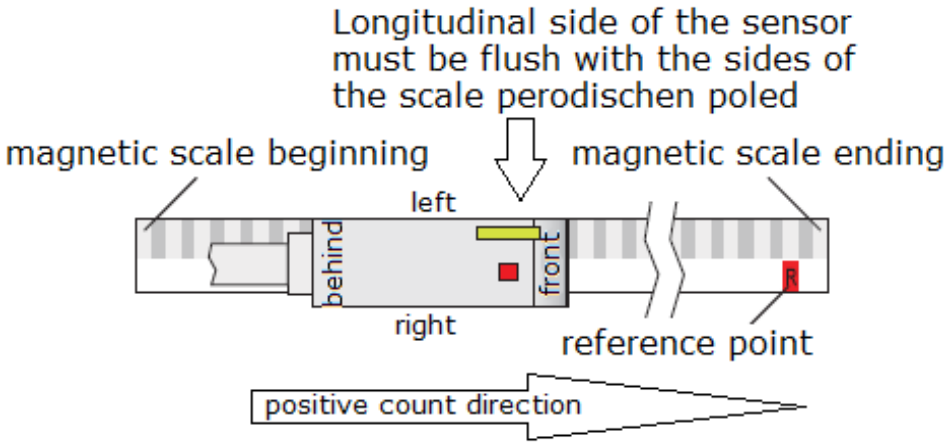
For digital models more values are available on request.

Dimensions

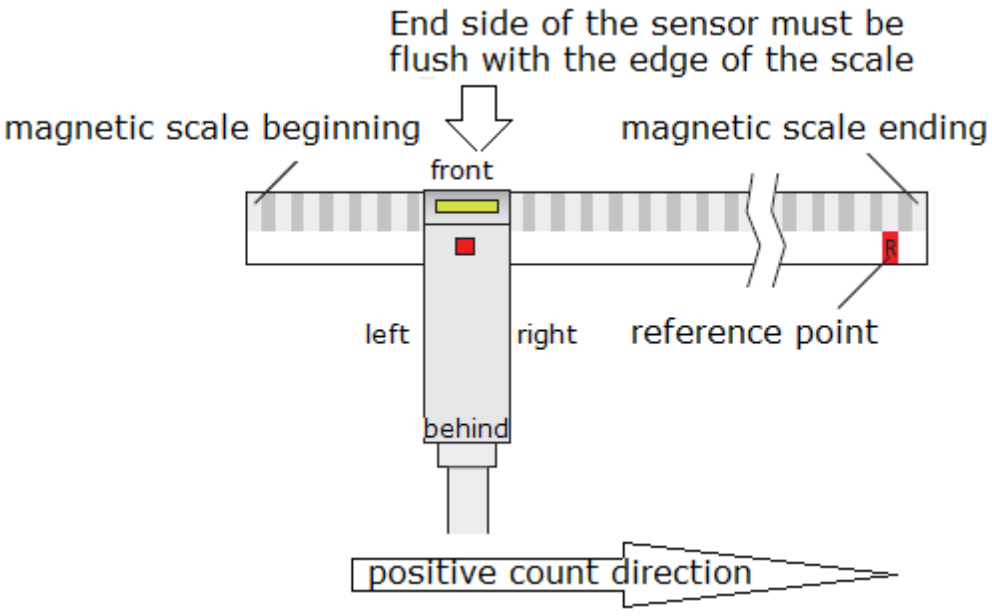


Mounting position

EHP



EHP/90



Ordering example

Type	EHP1	-	0	-	1	-	I	-	TTL	-	1,0/O	-	5	-	120

Pole pitch
1
2

Mounting position
0 = 0° (along the magnetic scale)
90 = 90° (transversely to the magnetic scale)

Resolution [µm] [1)]
0,5 / **1** / 2 / 5 / 10 / 20
= (no indication) at Vss

Reference signal
S = reference signal / fix-periodically
I = reference signal pole-periodically
O = without reference signal

Output signal
TTL = digital
VSS = analog (Vpp)

Cable length [m]
0,2 / 0,5 / **1,0** / 2,0 / 5,0 /

/Connector
C08 = M12; 8-pole
SUBD9 = Sub-D; 9-pole
O = open cable end

Power supply
5 = 5 VDC

Limited edition edge separation [ns] [2)]
See table

[1)] Specify when output signal TTL (digital)- further on request
[2)] Specify when output TTL (digital)

Magnetic scale, profiled rail, and cover tape
Please order the magnetic scale, the corresponding cover tape, and the profiled rail separately.
For ordering information, please refer to the corresponding data sheet.
You can configure the enclosure according to your requirements from the technical information and enter it into the ordering code.
Variants that cannot be configured from the ordering example are available on request as a special version.

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Ordering example Magnetic scale

Type	PM1	-	18	-	1000	-	O	-	DB01

Pole pitch [mm]
1; 2; 5

Accuracy (referred to a length of 1 m)
3 = 3 µm (max. 1000 mm)
5 = 5 µm
8 = 8 µm
10 = 10 µm
15 = 15 µm
18 = 18 µm
30 = 30 µm
36 = 36 µm
40 = 40 µm

Measuring rail
The length of the magnetic scale should be at each side 40 mm longer than the desired measuring length.
Length in mm for PM1; PM2
Length in m for PM5

Reference point [mm]
O = without
S50 = fix; specifying position of the right
SA50 = periodically; specifying position of the right

Cover tape
O = without
DB01 = for magnetic scale PM1 and PM2
DB22 = for profiled rail PS5 und PS6
DB50 = for profiled rail PS5

Ordering example Profiled rail

Type	PS1	-	1,0

PS1 = Pole pitch > 5+5 mm
PS5 = incl. cover tape DB22
PS6 = incl. cover tape DB22
SB

Measuring length [m]
The length of the profiled rail should be at each side 40 mm longer than the desired measuring length.

Ordering example Cover tape

Type	DB01	-	1,0

DB01 = for magnetic scale PM1 and PM2
DB22 = for profiled rail PS5 und PS6
DB50 = for profiled rail PS5

Measuring length [m]
The length of the cover tape should be at each side 40 mm longer than the desired measuring length.

Without prior notice, the products may be subject to modifications that the Manufacturer reserves to introduce as deemed necessary for their improvement.