# IKS9
Incremental Magnetic Sensing Head

The incremental sensing head IKS9 from BOGEN delivers reliable results in all industrial areas where positions, distances and speeds have to be measured. IKS9 features an accuracy of better than 10 μm, a travel speed of up to 100 m per second, an almost unlimited measuring length and a robust design. Numerous adjustable parameters allow the customer to easily adapt the IKS9 to application-specific needs. IP67 protection class allows use even in harsh environments. In combination with an appropriate scale - linear, rotary-radial or rotary-axial - a highly accurate, reliable and fast acquisition of measurement data is possible.

Incremental
Measuring

Rotary
Linear
Applications

Positioning
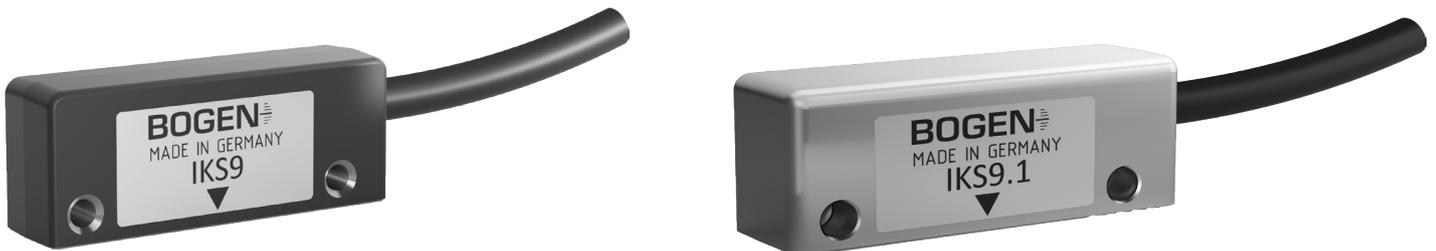
Features and Benefits

- high accuracy better than 10 μm

- resolution up to 20 nm

- movement speed up to 100 m/sec

- easy to adapt to application-specific needs

- resistant to contamination, vibrations, temperature, fluctuations, humidity

Features

resolution	0.02 - 1250 µm (depending on pole pitch)
max. movement speed	up to 100 m/s (depending on pole pitch, resolution and maximum output frequency)
energy consumption (without load)	< 65 mA (UB = 5 V)
operating temperature	- 20 to + 70 °C
storage temperature	- 20 to + 80 °C
protection class	IP67
LED[1]	green LED: set up ok
	red LED: error mode; for more details see „LED Error Codes (Order Parameter E1)" section in this document
adjustable parameters[2]	resolution/interpolation
	interface
	length of reference pulse
	frequency
	LED mode
	hysteresis
	counting direction
weight	without cable and connector
	IKS9: 6,5 g
	IKS9.1: 17,5 g
	cable: drag chain quality (T2): approx. 24 g/m
max. tightening torque for M3 screws(*)	0.4 Nm (3.5 lbf in)

[1] for additional information please see LED mode page 6

[2] with optional programming device and software

(*) lbf in = poundforce inch

Resolution and Speed
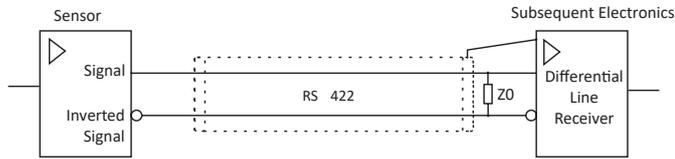
Default Values at Output Frequency F = 1000 kHz

Pole Pitch P [mm]	Resolution R [µm]	Max. Movement Speed Vmax [m/s]
0.5	0.25	1
1	0.5	2
2	1	4
2.54	1.27	5.08
5	2.5	10

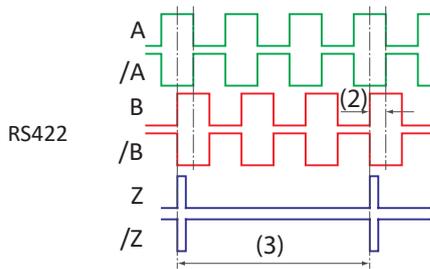# Sensing Head Variants

Pole pitch	0.5 mm; 1 mm; 2 mm; 2.54mm; 5 mm
Reference	Reference chip for 2nd track (except for 0.5 mm pole pitch) or periodically from the pole pitch
Supply voltage	5 V ± 5 %
	24 V on request
Interface (without load)	RS422 (0 to 5 V)
	Push-Pull TTL (0 - 5 V)
Cable length of sensing head	0.1 - 6 m
	standard: 1 m and 3 m
Connector	D-SUB 9 (male)
	D-SUB 15 (male)
	M12 inline connector 8 pin
	Customer specific connector

Output Circuit

RS422

Sensor

Subsequent Electronics

Signal

Inverted Signal

RS 422

Z0

Differential Line Receiver

load resistor Z0 = 120 Ω at receiving end

RS422

A
/A
B
/B
Z
/Z

(2)

(3)

Push-Pull (TTL)

Sensor

Signal

I_{Load}

R_L

Push-Pull

maximum of 50 mA per channel at a supply voltage of 5 V

Push-Pull
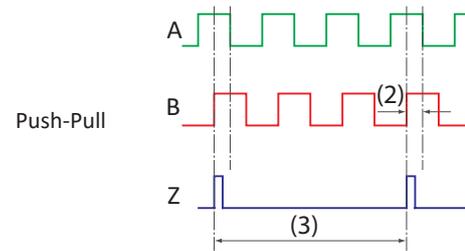
A
B
Z

(2)

(3)

[2] phase shift A and B 90° ± 10° electrical

[3] signal period depending on the reference track pattern or as a periodic reference depending on pole pitch

Z: length default is 50 counts

Output Signals

signals	A, /A, B, /B, Z, /Z
signal error indicator	high impedance on all output signals (A, /A, B, /B, Z, /Z)

To avoid EMI please connect housing or threaded bushing to protective earthing!

Further Selection (Ordering Parameters)

pole pitch P [mm]					resolution R [µm]	resolution Rdpi [dpi]	maximum output frequency per channel F [kHz]					
0.5	1	2	2.54	5			3500	1750	1000	500	100	60
			(0.1 in)				max. movement speed V_{max} [m/s]					
				x	1250	20.32	>100	>100	>100	>100	>100	>100
		x		x	500	50.8	>100	>100	>100	>100	>100	>100
	x	x		x	200	127	>100	>100	>100	>100	80	48
x	x	x		x	100	254	>100	>100	>100	>100	40	24
		x			80	317.5	>100	>100	>100	>100	32	19.2
x	x	x		x	62.5	406.4	>100	>100	>100	>100	25	15
x	x	x		x	50	508	>100	>100	>100	>100	20	12
	x	x		x	40	635	>100	>100	>100	80	16	9.6
x	x	x		x	25	1016	>100	>100	>100	50	10	6
x	x	x	x	x	20	1270	>100	>100	80	40	8	4.8
x	x	x		x	12.5	2032	>100	87.5	50	25	5	3
x	x	x	x	x	10	2540	>100	70	40	20	4	2.4
x	x	x	x	x	5	5080	70	35	20	10	2	1.2
x	x	x	x	x	4	6350	56	28	16	8	1.6	0.96
x	x	x	x	x	2.5	10160	35	17.5	10	5	1	0.6
x	x	x	x	x	2	12700	28	14	8	4	0.8	0.48
x	x	x	x	x	1	25400	14	7	4	2	0.4	0.24
x	x	x	x	x	0.5	50800	7	3.5	2	1	0.2	0.12
x	x	x	x	x	0.25	101600	3.5	1.75	1	0.5	0.1	0.06
x	x	x	x	x	0.125	203200	1.75	0.875	0.5	0.25	0.05	0.03
x	x	x	x		0.05	508000	0.7	0.35	0.2	0.1	0.02	0.012
x	x				0.02	1270000	0.28	0.14	0.08	0.04	0.008	0.0048

table 1: maximum output frequency and speed as a function of pole pitch and resolution

Definition

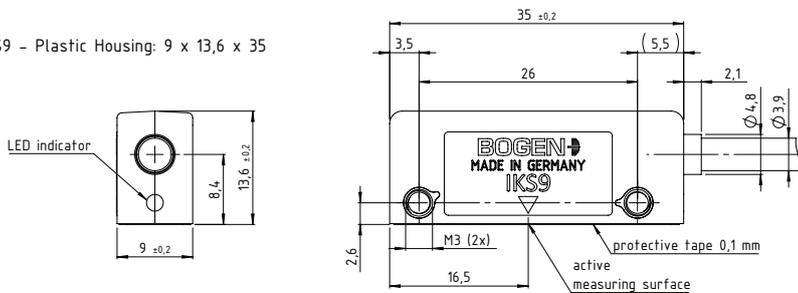| pole pitch P	available 0.5; 1; 2; 2.54 and 5 mm
resolution R	R = P / Rf resolution is after four-edge analyses
resolution Rdpi [dpi]	Rdpi = 25400 / R
resolution factor Rf	resolution factor available from 4 to 65536 in steps of one
maximum output frequency per channel F	available from 60 kHz to 3500 kHz
max. movement speed V_{max}	V_{max} is limited by following conditions: 1. $V_{max} = 4 * F * R$ 2. $V_{max} = P * 50\ kHz$
interpolation	= Rf / 4

LED Error Codes (Order Parameter E1)

The amount of flashing signs of the red LED indicates the fault. It starts after a fast pulsed light.

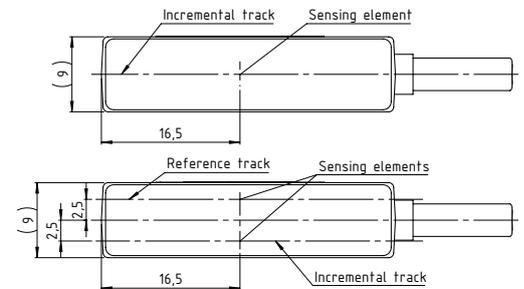The example displays a weak and fluctuating magnetic field (fault 2 and 3).

LED flashing signs amount	description
1	magnetic field strength is too high
2	magnetic field strength is too low
3	the range of the magnetic fluctuation is too large
4	output frequency is too high
5	movement speed is too high
6	movement speed is much too high (latched)
7, 8	movement speed too high for internal signal processing with current programming (latched)
9, 10, 11	internal error 9, 10, 11 (latched)

Dimensions

IKS9 – Plastic Housing: 9 x 13,6 x 35

IKS9.1 – Zinc Die Cast Housing: 11 x 14,1 x 36

View on active measuring surface (with and without reference track)
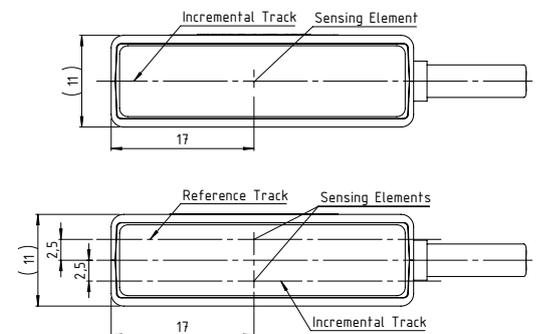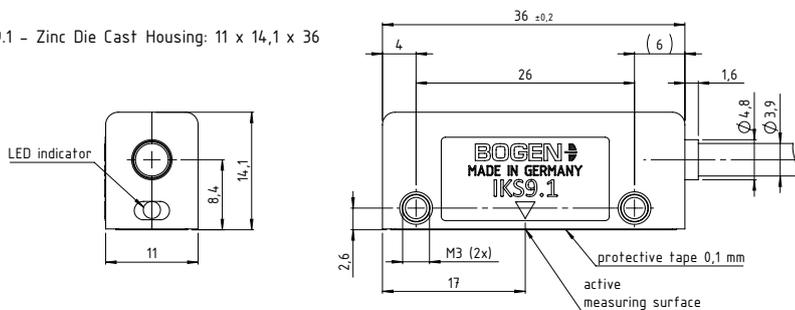
dimensions without tolerances: ± 0.1 mm; forward movement: in positive direction of X-axis; backward movement: in negative direction of X-axis.

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Installation Tolerances for Linear Applications
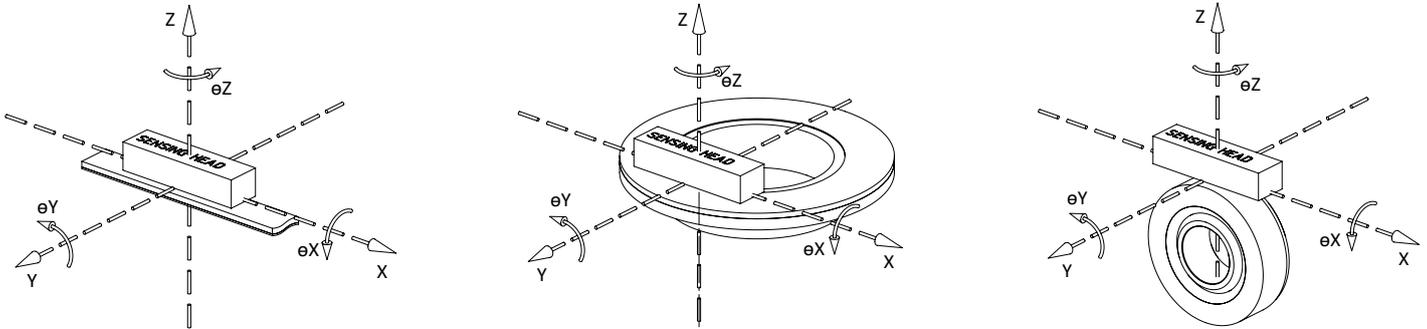
	pole pitch				
	0.5 mm	1 mm	2 mm	2.54 mm	5 mm
Z [mm]	0.1 to 0.25	0.1 to 0.5	0.1 to 1.0	0.1 to 1.25	0.1 to 2.5
Y [4] [mm]	2.5	2.5	2.5	2.5	2.5
Y [5] [mm]	0.5	0.5	0.5	0.5	0.5
θY	0.5°	1°	1°	1°	1°
θX	3°	3°	3°	3°	3°
θZ	3°	3°	3°	3°	3°

[4] relative to 10 mm scale width (1-track)

[5] relative to 10 mm scale width (2-track)

Pin Assignment

signal	colour	C3 D-SUB 9 (male)	C4 D-SUB 15 (male)	C7 M12 plug (male)
V −	blue	9	2	1
V +	red	5	7	2
A	brown	4	14	3
/A	green	8	6	4
B	grey	3	13	5
/B	yellow	7	5	6
Z	pink	2	12	7
/Z	white	6	4	8
shield	–	case	case	coupling screw

C3: D-SUB 9 (male)

C4: D-SUB 15 (male)

C7: M12 plug (male)

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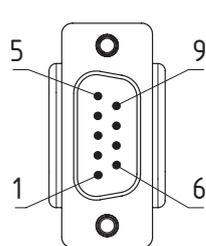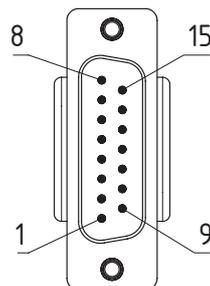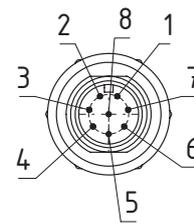
Order Code

IKS9 - W - Z - P - V - D - R - F - T - L - C - E

		Code [8]	Explanation [8]
W	width [mm]		9 mm (Plastic case)
		.1	11 mm (Metal case)
Z	reference signal (9,10)	**Z1.50**	**periodic reference signal from the pole pitch, length of reference signal 50 counts**
		Z1. ...	periodic reference signal from the pole pitch, length of reference signal ... counts [11]
		Z2. ...	from reference marks (requires 2-track magnetic tape with incremental track and reference track), length of reference signal ... counts [11]
P	pole pitch [mm]	P0.5	0.5 mm (not interoperable with Z2)
		P1	1 mm
		P2	**2 mm**
		P2.54	2.54 mm
		P5	5 mm
V	supply voltage [V]	**V5**	**5 V**
D	interface (9)	**D1**	**RS422**
		D3	Push-Pull TTL
R	resolution (9, *)	R0.25	0.25 µm (Standard for pole pitch 0.5 mm)
		R0.5	standard for pole pitch 1 mm
		R1	**standard for pole pitch 2 mm**
		R#...	...dpi (Standard for pole pitch 2.54 mm)
		R2.5	standard for pole pitch 5 mm
		R ...	other non-standard resolutions, see section "Resolution and Speed" in table 1 on page 2
F	maximum output frequency per channel (9) [kHz]	**F1000**	**1000 kHz**
		F ...	other non-standard output frequencies, see section "Resolution and Speed" in table 1 on page 2
T	cable type	**T2**	**drag chain quality (4 mm diameter) [12]**
		T99	customer specific cable
L	cable length	**L1**	**1 m**
		L3	**3 m**
		L ...	... m (maximum cable length: 6 m)
C	connector	C0	open leads (no connector)
		C3	**D-SUB 9 (male)**
		C4	D-SUB 15 (male)
		C7	M12 inline connector 8 pin
		C99	customer specific connector
E	LED Mode (9)	E0	LED Green: Low -> sufficient magnetic field Bright -> best performance LED RED: Error signalization with LED on
		E1	**LED Green: Low -> sufficient magnetic field** **Bright -> best performance** **LED RED: Error signalization with blinking codes, see on page 3**

[8] standard parameters are bold

[9] user programmable parameters (optional IKS-Programming device necessary)

[10] if no index signal is needed, please do not connect pin "Z" an "/Z" on delivered connector

[11] length of index signal available from 1 to 256

[12] recommended bending radius for permanently installed cables: 20 mm; for freely movable cables: 40 mm

[*] R... for metric based pole pitches / R#... for inch based pole pitches

Ordering Example

IKS9-Z1.50P2V5D1R1F1000T2L3C3E1

IKS9 Magnetic Sensing Head,
width 9 mm,
with periodic reference signal,
reference length 50 counts,
2 mm pole pitch,
voltage 5 V,
interface RS422,
1 µm resolution,
max. output frequency 1000 kHz,
drag chain quality (4 mm diameter),
cable length 3 m,
D-SUB 9 (male) connector,
error signalization with blinking error codes

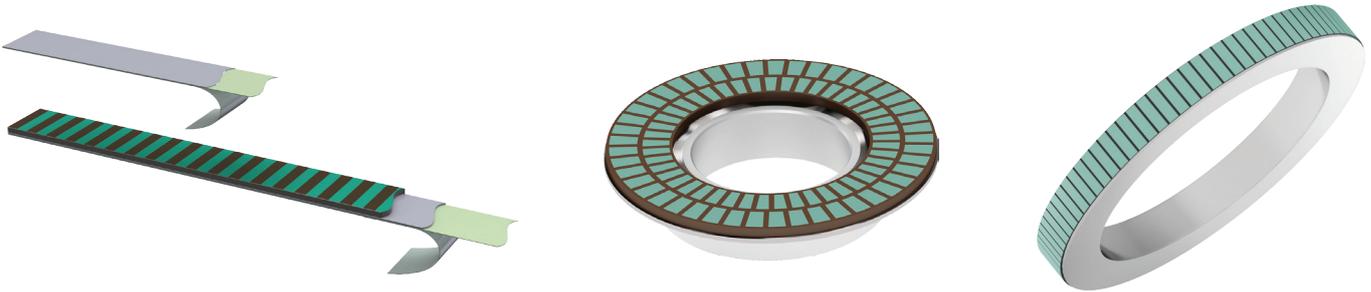BOGEN can provide customised resolutions and cables. This is an example for a customized order code:

IKS9.1-Z2.50P2V5D1R0.244140625F3500T2L0.3C4E1

IKS9 Magnetic Sensing Head,
width 11 mm,
with reference signal from reference marks (2-track magnetic tape),
reference length 50 count,
2 mm pole pitch,
voltage 5 V, interface RS422,
0.244140625 µm resolution,
max. output frequency 3500 kHz,
cable length 0.3 m,
D-SUB 15 (male) connector,
error signalization with blinking error codes

Corresponding Linear and Rotary Magnetic Scales

BOGEN offers a comprehensive scope of standard and tailor-made scales in a variety of sizes and accuracy classes.

For more information on our standard linear and rotary magnetic scales, please refer to our dedicated datasheets.

For your special requests, please click here to contact our application engineers.

Optional Accessory

• programming unit for IKS9 [00053024]

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