



Measuring



Positioning

IKS9

Incremental Magnetic Encoder

- For linear applications
- For rotary applications
- For scales with or without reference



Features

- High accuracy better than 10 μm
- Resolution up to 20 nm
- Movement speed up to 100 m/sec
- Easy adaption to application-specific needs
- Resistant to contamination, vibrations, temperature, fluctuations, humidity
- No wear from usage
- Corresponding scales in various lengths and diameters, with various pole pitches, with or without reference

Magnetic measuring with IKS9: accurate - fast - customized

BOGEN's incremental encoder IKS9 impresses customers in all industrial fields where positions, distances and speed have to be measured. An accuracy better than 10 μm , a movement speed up to 100 m per second, an almost unlimited measuring length and a robust design are the characteristics of this encoder. Several adjustable parameters allow an easy modification of the IKS9 to application-specific needs by the customer himself. The protection class IP67 allows the implementation even in harsh environment. In combination with a corresponding scale - linear, rotary-radial or rotary-axial - a highly accurate, reliable and fast collection of measuring data is possible.

Features

Resolution	0.02 - 1250 μm (depending on the 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: LED Error Mode see order codes on Page 6
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
Maximum tightening torque for M3 screws (*)	0.4 Nm (3.5 lbf in)

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 \pm 5 %
Interface (without load)	RS422 (0 to 5 V) Push-Pull TTL (0 - 5 V)
Cable length of sensing head	available from 0.1 to 6 m standard is 1 m or 3 m
Connector	D-SUB 9 (male) D-SUB 15 (male) D-SUB 25 (female) D-SUB 15 HD (male) Customer specific connector

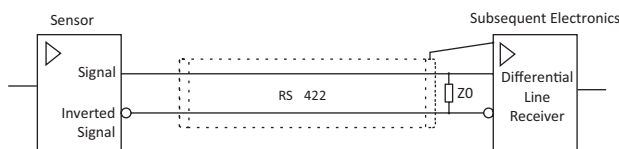
⁽¹⁾ for additional information please see LED Mode on Page 6

⁽²⁾ with optional programming device and software

^(*) lbf in = poundforce inch

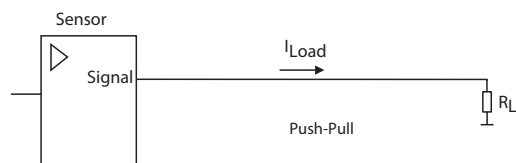
Output Circuit

RS422

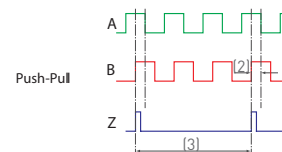
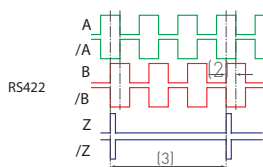


Load resistor Z0 = 120 Ω at the receiving end

Push-Pull (TTL)



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



Output Signals

Signals	A, /A, B, /B, Z, /Z
Signal error indicator	High impedance on all output signals (A, /A, B, /B, Z, /Z)

(2) Phase shift A and B 90° \pm 10° electrical

(3) Signal period depending on the reference track pattern or as a periodic reference depending on the pole pitch

Z Length default is 50 counts

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 inch)							Max. Movement Speed Vmax [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:

Resolution R (resolution is after four-edge analyses)

Pole pitch P (available 0.5; 1; 2; 2.54 and 5 mm)

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}

Interpolation = $Rf / 4$

$R = P / Rf$

Resolution [dpi] $Rdpi$

$Rdpi = 25400 / R$

V_{max} is limited by following formulars:

- $V_{max} = 4 * F * R$
- $V_{max} = P * 50 \text{ kHz}$

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.

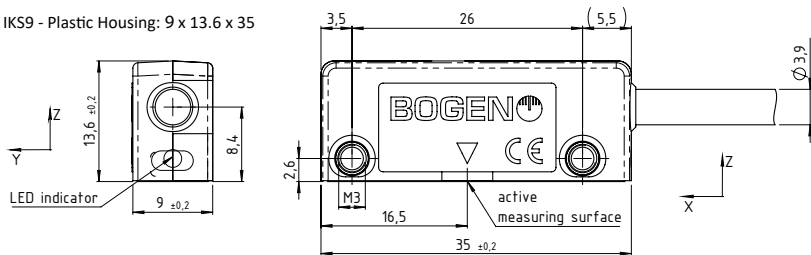


The example displays a weak and fluctuating magnetic field (fault 2 and 3).

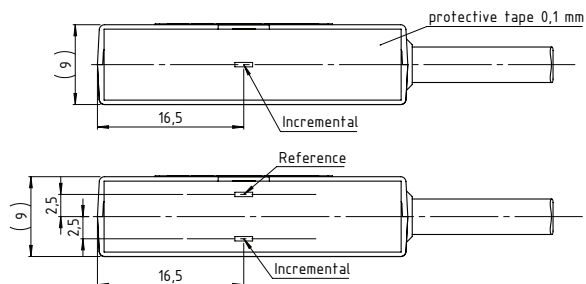
LED flashing signs amount	Description
1	Magnetic field strength is too high
2	Magnetic field strength is too low
3	The range of the magnetic fluctuation is too large
4	Output frequency is too high
5	Movement speed is too high
6	Movement speed is much too high (latched)
7, 8	Movement speed too high for internal signal processing with current programming (latched)
9, 10, 11	Internal Error 9, 10, 11 (latched)

Dimensions

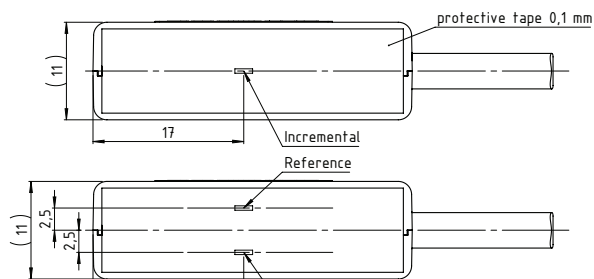
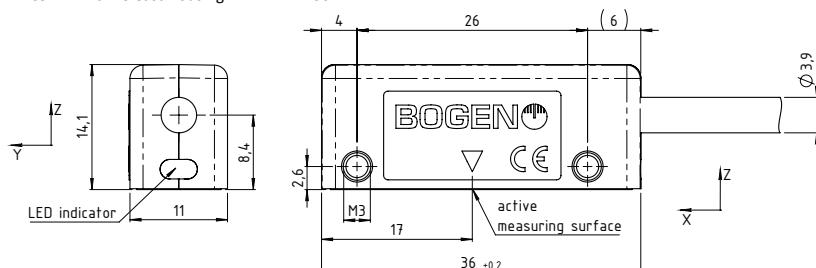
IKS9 - Plastic Housing: 9 x 13.6 x 35



View on active measuring surface

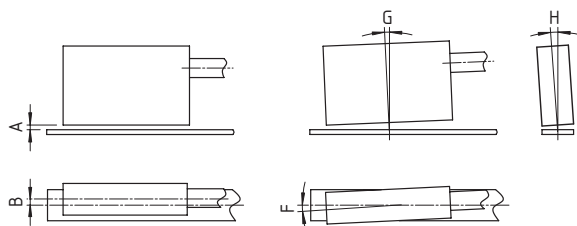


IKS9.1 - Zinc Die Cast Housing: 11 x 14.1 x 36



Dimensions without tolerances: ± 0.1 mm.
 Forward movement: in positive direction of X-axis
 Backward movement: in negative direction of X-axis

Installation Tolerances for Linear Applications



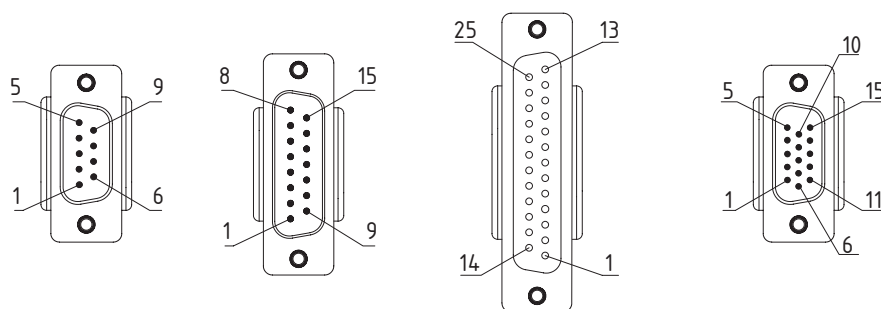
	pole pitch				
	0.5 mm	1 mm	2 mm	2.54 mm	5 mm
A [mm]	0.1 to 0.25	0.1 to 0.5	0.1 to 1.0	0.1 to 1.25	0.1 to 2.5
B ⁽⁴⁾ [mm]	2.5	2.5	2.5	2.5	2.5
B ⁽⁵⁾ [mm]	0.5	0.5	0.5	0.5	0.5
G	0.5°	1°	1°	1°	1°
H	3°	3°	3°	3°	3°
F	3°	3°	3°	3°	3°

⁽⁴⁾ relative to 10 mm scale width (1-track)
⁽⁵⁾ relative to 10 mm scale width (2-track)

Pin Assignment

Signal	Color				
		C3 D-SUB 9 (male)	C4 D-SUB 15 (male)	C5 D-SUB 25 (female)	C6 D-SUB 15 HD (male)
V -	blue	9	2	2 + 16 ^[6]	2
V +	red	5	7	1 + 14 ^[6]	7
A	brown	4	14	3	14
/A	green	8	6	4	6
B	grey	3	13	6	13
/B	yellow	7	5	7	5
Z	pink	2	12	17	12
/Z	white	6	4	18	4
Shield	-	Case	Case	Case	Case + 15

^[6] PIN 1 with Pin 14 and Pin 2 with Pin 16 connected through solder bridge



C3: D-SUB 9 (male)

C4: D-SUB 15 (male)

C5: D-SUB 25 (female)

C6: D-SUB 15 HD (male)

For detailed technical features on optional accessories such as rotary and linear scales please see separate data sheets.

Optional Accessory

- Programming unit for IKS9 [00053024]
- Linear and rotary scales (for detailed information see separate data sheets)
 - » LMS: Linear magnetic scale from few mm to many meters
 - » LMSBI: Linear magnetic scale bar incremental for high accuracy applications
 - » RMSI: Rotary magnetic scale incremental in diameters from 10 mm to 1 m
 - » Recommended width without reference track: 5 mm, 6 mm, 8 mm, 10 mm
 - » Recommended width with reference track: 8 mm, 10 mm
 - » Available accuracy classes: A3, A10, A20, A40, A100
 - » Available pole pitches: 0.5 mm, 1 mm, 2 mm, 2.54 mm, 5 mm

Order Code

Parameters

 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,*1)	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)
		T99	Customer specific cable
L	Cable Length [m]	L1	1 m
		L3	3 m
		L...	... m (maximum cable length: 6 m)
C	Connector (others on request)	C3	D-SUB 9 (male)
		C4	D-SUB 15 (male)
		C5	D-SUB 25 (female)
		C6	D-SUB 15 HD (male)
		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

^(*) R... for metric based pole pitches / R#... for inch based pole pitches

Ordering Example

IKS9-Z1.50P2V5D1R1F1000T2L2C4E1	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 μ m resolution, max. output frequency 1000 kHz, Drag chain quality (4 mm diameter), cable length 2 m, D-SUB 15 (male) connector, error signalization with blinking error codes
IKS9.1-Z2.1P5V24D3R125F100T2L5.5C5E0	IKS9 Magnetic Sensing Head, width 11 mm, with reference signal from reference marks (2-track magnetic tape), reference length 1 count, 5 mm pole pitch, voltage 7-32 V (broad-range), interface Push-Pull TTL, 125 μ m resolution, max. output frequency 100 kHz, Drag chain quality (4 mm diameter), cable length 5.5 m, D-SUB 25 (female) connector, error signalization with LED RED on

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

IKS9.1-Z2.50P2V5D1R0.244140625F3500T99L0.3C4E1	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 μ m resolution, max. output frequency 3500 kHz, customer specific cable, cable length 0.3 m, D-SUB 15 (male) connector, error signalization with blinking error codes
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