목록

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IKS9

Incremental Magnetic Sensing Head

Incremental Measuring

Rotary Linear Applications

Positioning

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.

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

IKS9 rev 3.9 (2023/03/21)

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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

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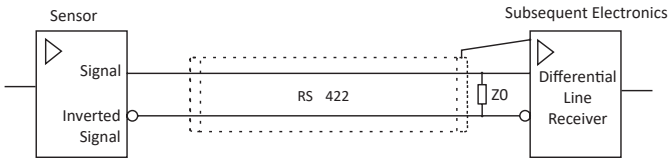
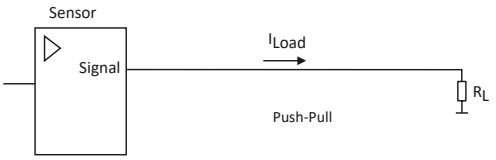
Output Circuit

RS422

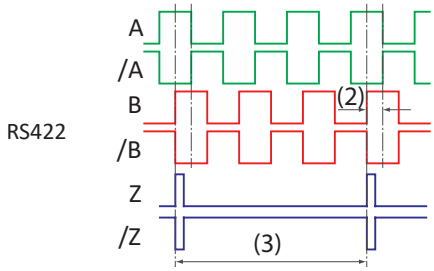


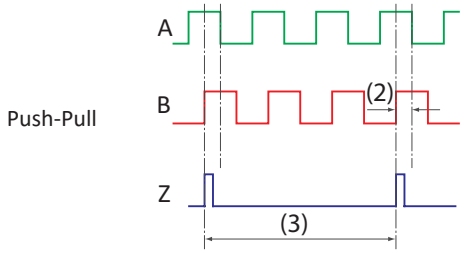
load resistor Z0 = 120 Ω at receiving end

Push-Pull (TTL)



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





[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!

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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

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LED Error Codes (Order Parameter E1)

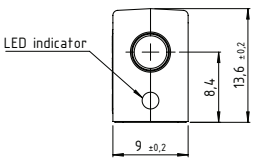
The amount of flashing signs of the red LED indicates the fault. It starts after a fast pulsed light.

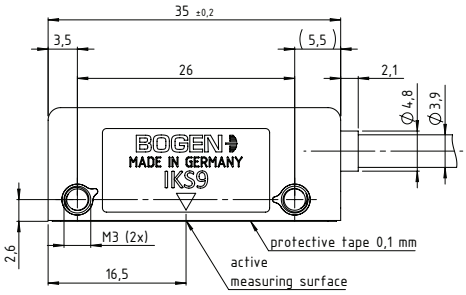
The example displays a weak and fluctuating magnetic field (fault 2 and 3).

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)

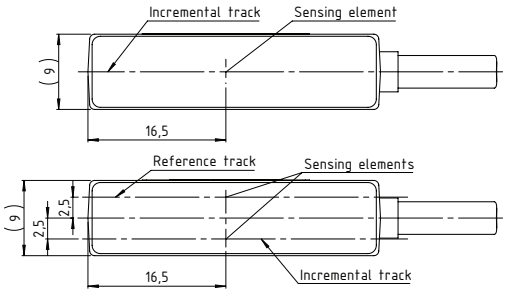
Dimensions

IKS9 – Plastic Housing: 9 x 13,6 x 35

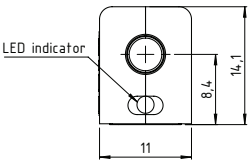


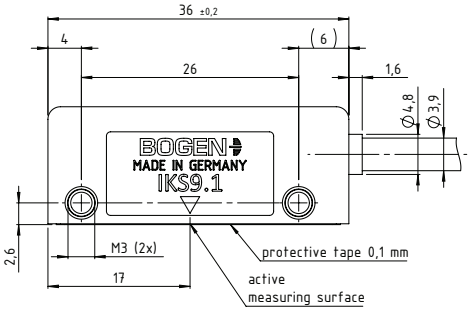


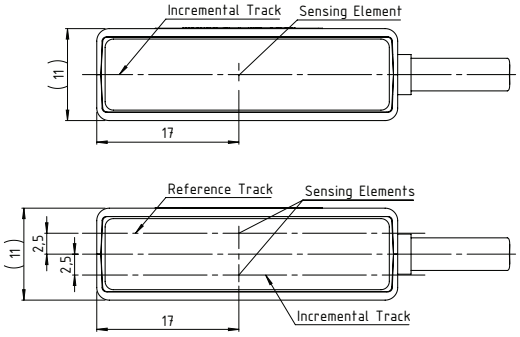
View on active measuring surface
(with and without reference track)



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.

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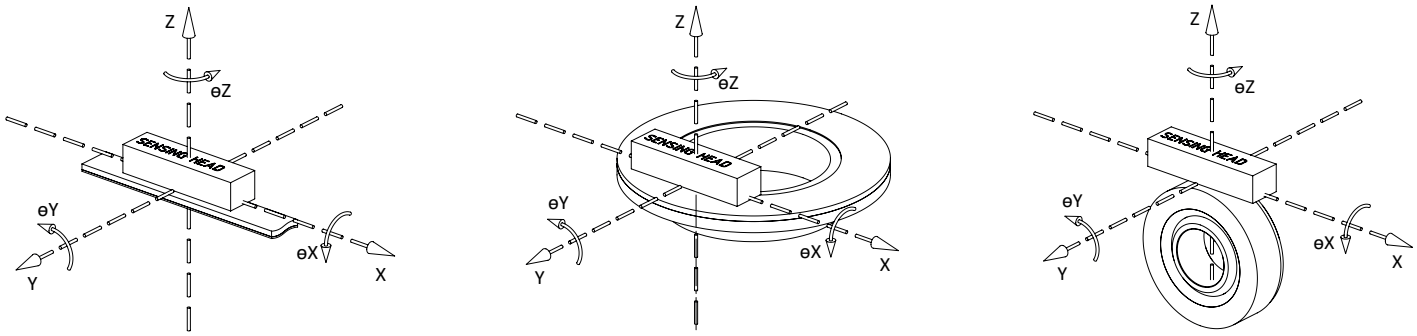
Installation Tolerances for Linear Applications



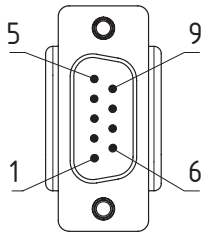
	pole pitch				
	0.5 mm	1 mm	2 mm	2.54 mm	5 mm
Z [mm]	0.1 to 0.25	0.1 to 0.5	0.1 to 1.0	0.1 to 1.25	0.1 to 2.5
Y [4] [mm]	2.5	2.5	2.5	2.5	2.5
Y [5] [mm]	0.5	0.5	0.5	0.5	0.5
θY	0.5°	1°	1°	1°	1°
θX	3°	3°	3°	3°	3°
θZ	3°	3°	3°	3°	3°

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

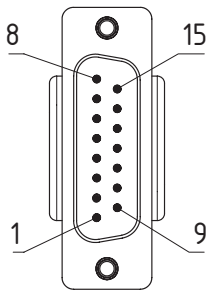
[5] relative to 10 mm scale width (2-track)

Pin Assignment

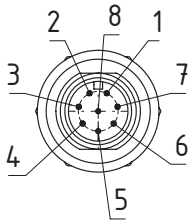
signal	**colour**	C3 D-SUB 9 (male)	C4 D-SUB 15 (male)	C7 M12 plug (male)
V -	blue	9	2	1
V +	red	5	7	2
A	brown	4	14	3
/A	green	8	6	4
B	grey	3	13	5
/B	yellow	7	5	6
Z	pink	2	12	7
/Z	white	6	4	8
shield	-	case	case	coupling screw



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	**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

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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

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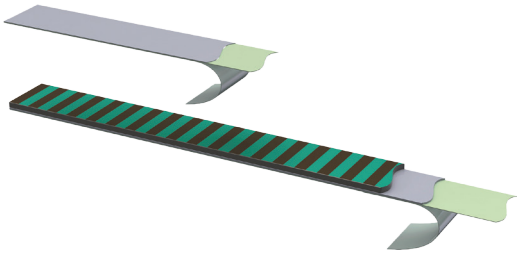
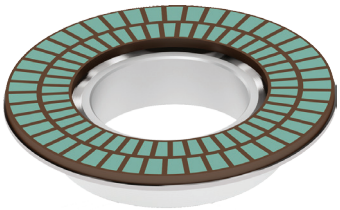
Corresponding Linear and Rotary Magnetic Scales

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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IKS9
IKS9.1
Incremental Magnetic Sensing Head

INSTALLATION AND OPERATION INSTRUCTIONS

IKS9 Ops Manual rev 2.0 (2022/12/06)

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Safety Instruction

Read these instructions carefully prior to installation and operation.

This manual is intended for professionals who perform the installation and the setup. The assembly of the system requires knowledge of mechatronics and general health and safety regulations. Follow all warnings and instructions for your own safety and the safety of your system.

These operating instructions apply to the incremental magnetic sensing head IKS9 in connection with a magnetic scale for linear or rotary applications.

Risk of electric shock or short circuit!
Incorrect handling of electrical equipment can be fatal or cause damage to property.

Danger to life!
Unauthorized use of the system can be highly dangerous.
The magnetic position sensing heads must not be used in life-saving systems such as airplanes etc.

Risk of pinching
There is a risk of getting pinched between the sensing head and the magnetic tape. This can lead to injury or mechanical damage. Avoid getting with your limbs and tools near the gap between the head and the tape while the measuring system is in motion!

Dangers that may follow
Malfunctions of the measuring system can lead to further risks to the device or the system in which it is embedded. When there is evidence that the measuring system is not working properly, it must be put out of operation and secured against unauthorized use. The prescribed safety regulations must be observed for the use of position sensing heads. In particular, measures must be taken to prevent dangers to people and property in the event of a failure. This includes the installation of additional safety limit switches, emergency stop switches and the observance of the required environmental conditions

Risk of damage for the magnetic layer
Magnetic tapes and sensing heads can be damaged by magnetic fields!
Apply only demagnetized tools for assembly and maintenance!
Improper storage of magnetic tape rolls can lead to magnetic interaction between the layers and thus to a reduction of the measurement accuracy

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Electromagnetic Compatibility

For the electrical connection it is essential that the electromagnetic compatibility (EMC) is guaranteed.

- System and control cabinet must be connected to the same ground potential.
- Use shielded cables. Connect the cabinet side of the cable shield with protective earth (PE).
- Avoid installing in close proximity to power lines.
- The nominal operating voltage (see datasheet) must be observed even if there is a voltage drop along the supply line!
- Determine the place of installation so that inductive and capacitive interferences cannot affect the sensor. By adequately routing the cable, interferences can be reduced.

Intended Use

The incremental magnetic sensing heads IKS9 are part of a highly accurate measuring system consisting of magnetic scales and sensing heads capable of contactless position detection for linear and rotary applications.

Fields of deployment:

- mechanical engineering
- automation
- medical engineering
- electrical engineering.

The system consists of a sensing head and a linear or rotating magnetic scale and can be incorporated into various electronic systems. It can be configured according to the customer's demands. In combination with a suitable analysis software absolute and relati-ve position and position changes can be measured. In this way it is possible, for instance, to control machi-ne tools, determine torsional forces or detect longitu-dinal expansions.

Function and Properties

The incremental magnetic sensing heads IKS9 are suitable for non-contact, incremental distance measuring systems. The measuring function is realized by magnetic scanning.

The system has the following features:

- non-contact, quick position measurement
- high reproducability
- programmable with PC
- freely programmable resolutions
- adjustable maximum output frequencies

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- different connectors with adaptable cable lengths
- no wear from usage
- high gap tolerance
- resistant to dust, cooling lubricant emulsion, oil, etc.
- unlimited measuring distance.

Mode of operation

The sensing head with its sensor is mounted on the machine part whose position is to be measured. The measuring magnetic scale is mounted along the measuring distance. On the magnetic scale alternating magnetic north and south poles are positioned with a regular distance. The magnetic AMR sensor cells (anisotropic magnetoresistive effect) in the sensing head are scanning the magnetic poles on the scale contact-free.

Permissive travelling speed

See technical data sheet of the respective type on the website: www.bogen-magnetics.com/download

Digital output

The sensing head with digital output signals converts the analog signals into a digital quadrature signal (A/B pulses) and transmits them to the controller. The two digital square wave signals A and B are electrically phase shifted by 90°.

The sign of the phase shift indicates the direction of movement of the sensing head. Every change of A or B (rise to fall or vice versa) is a count for the incremental counter (up/down counter). If signal A is in advance, the counter increments. If signal B is in advance, the counter decrements. The controller thus knows at all times the position of the sensing head, without having to query the sensor periodically (real-time capability).

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: set up ok red: LED error mode
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, IKS9.3: 19,7 g, cable drag chain quality (T2): approx. 24 g/m
maximum tightening torque for M3 screws*	0.4 Nm (3.5 lbf in)

[2] with optional programming device and software

[*] lbf in = poundforce inch

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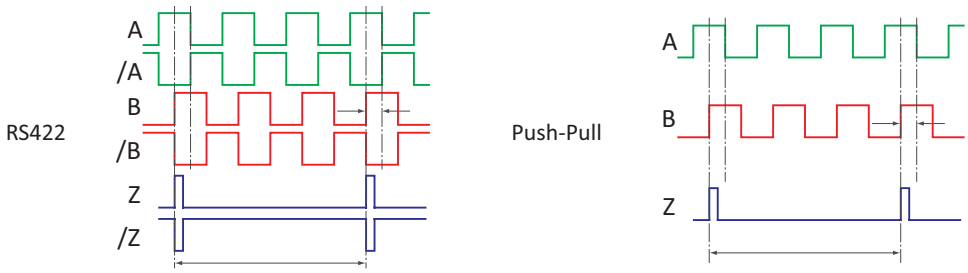
Sensing Head Variants

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 % 7 - 36 V
interface (without load)	RS422 (0 to 5 V) Push-Pull HTL (0 V to supply voltage) Push-Pull TTL (0 - 5 V)
cable length of sensing head	0.1 - 6 m standard: 2 m
connector	D-SUB 9 (male) D-SUB 15 (male) D-SUB 25 (female) D-SUB 15 HD (male) customer specific connector

Please note: to ensure proper function, the A and B signals have to be evaluated depending on their direction.



Assembly and Installation

During assembly, utmost cleanliness is required. Device parts have to be degreased thoroughly before gluing.

During installation, the mounting tolerances, the position of the incremental measuring point, and the realization of the reference point have to be observed resp. implemented as stated in the datasheet.

Delivery Condition

The IKS9 can be supplied with different connector variants. For pin assignment, see the datasheet.

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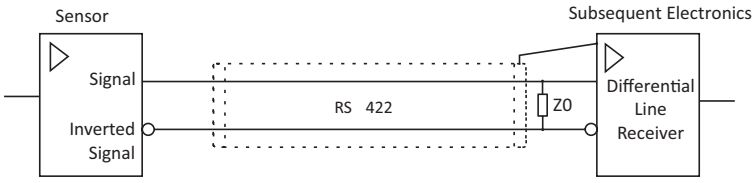
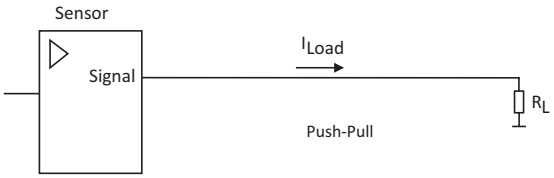
Electrical Connection

The following figure shows the output circuit which integrates the sensing head into a system:





Programming Device

Introduction

With the IKS9 programming device the parameters of an incremental sensing head IKS9 can be changed. These parameters include:

- resolution/Interpolation
- interface
- length of reference signal pulse
- upper frequency limit
- LED mode
- hysteresis
- counting direction.

In the following the programming procedure and the operation of the programming device and the software is described. To calibrate the sensing head you need following:

System requirements

The programming device can be connected to a Windows PC with a USB cable and operated with the dedicated software. The software requires Windows Vista or later (32/64 Bit).

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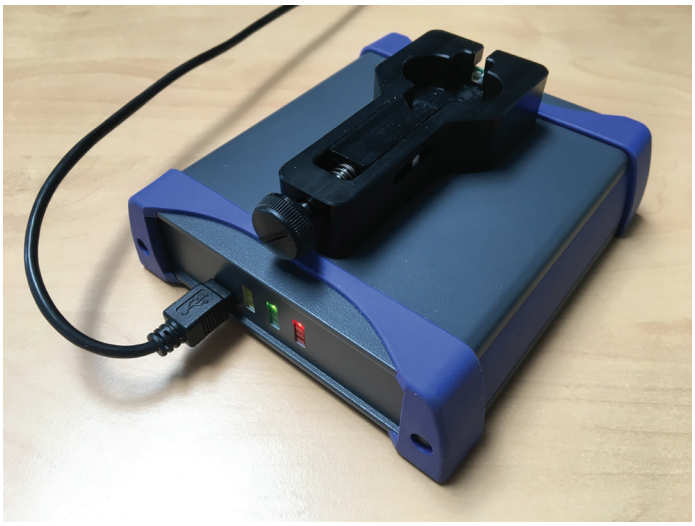
Programming Device Driver

Before the programming device can be connected the specific driver must be installed.

To install the driver, execute the specific program according to your operating system from the directory "driver":

- for 32 Bit operation systems: „CP210xVCPInstaller_x86.exe"
- for 64 Bit operation systems: „CP210xVCPInstaller_x64.exe".



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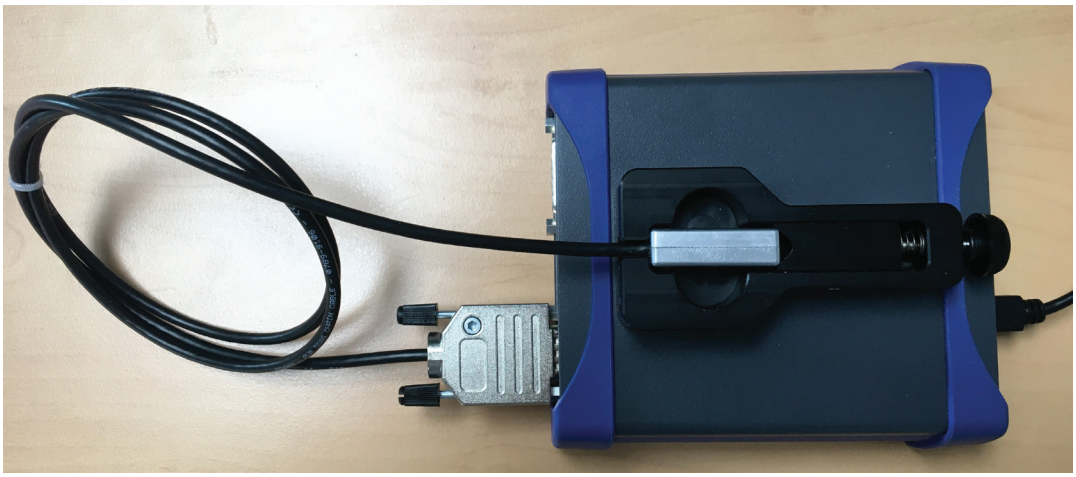
Programming Software

Download the software from the BOGEN homepage, copy it to a local directory and extract the zip-file. The software does not need to be installed. It can be started immediately by double-clicking "IksUserProgrammer.exe".

Connecting the Device

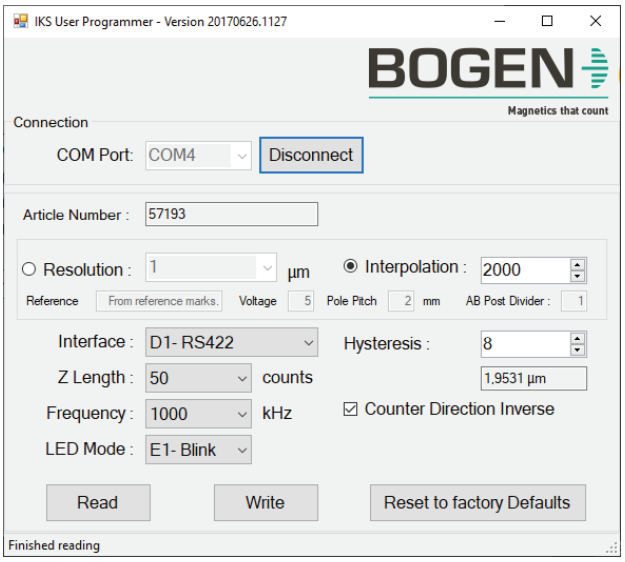
Before starting the software, the programming device must be connected to your computer using the USB cable supplied. Then insert the sensing head into the dedicated mount, connect it to the programming device and start the program.



Note: Before the sensing head can be connected it must be plugged onto the dedicated holder!

Configuring the IKS9

Connect the programming device and the sensing head as described, start the software, select the COM port in the drop-down selection and confirm by clicking "connect".



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The parameter setup of the sensing head is now read out and shown in the respective fields of the user interface.

Selectable parameters are:

- resolution/interpolation
- interface
- length of reference pulse
- frequency
- LED mode
- hysteresis
- counting direction

Make the desired changes to the parameters. By clicking "Write" the data gets stored in the sensing head. This process can take a few seconds.

By choosing "Reset to factory Defaults" all parameter changes will be made undone and set back to factory settings.

Commissioning

Verify general system operation

After mounting the measuring system or after replacing the sensing head, verify general system operation as follows:

- switch on the supply voltage of the sensing head
- move the sensing head along the entire measure-ment path or revolution
- check that all signals are present at the output
- check if the counting direction matches the movement direction/direction of rotation. If this is not the case, change the counting direction in the user interface of the programming device.

Maintenance

The functionality of the measuring system and all related components must be reviewed and recorded regularly.

For more information and data sheets go to our website

https://www.bogen-magnetics.com/

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Appendix

Troubleshooting

If there are signs of interference or malfunctioning, the measurement system must be put out of operation and secured against unauthorized use.

Fault / Error Message	Possible cause	Measures
The controller does not receive path information.	The necessary voltage supply is not present	Check if the power supply is present and if the sensing head is connected properly.
	The voltage is too low or too high.	The measuring system must have the specified operating voltage.
	The cables are not connected properly.	Check connections for compliance with the circuit diagrams.
	The gap between sensing head and magnetic tape is too large or too little.	Adjust the mounting height of the sensing head
The controller does not receive path information at some locations.	The magnetic poles of the magnetic tape are damaged in some places.	Replace the magnetic tape.
Position signal is very noisy.	Contacts are poorly shielded	Use shielded cables, ensure proper contacting.
The linearity deviation is out of tolerance.	The sensing head does not move in parallel to the magnetic tape. The gap between the sensing head and the magnetic tape is too large.	Re-position the sensing head properly.
	Thermally induced length variations (related to 20°C).	Provide electronic temperature compensation in the electronic evaluation unit.

EU Declaration of Conformity

According to EU regulation for Electromagnetic Compatibility 2004/108/EU and European Standard for Electromagnetic Compatibility EN 61326-1:2006 (EMC)

BOGEN Magnetics GmbH, Potsdamer Str. 12 - 13, 14163 Berlin, Germany

declares that

incremental magnetic sensing head IKS9, manufactured since 2020,

complies with the above-mentioned regulations and standards.

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