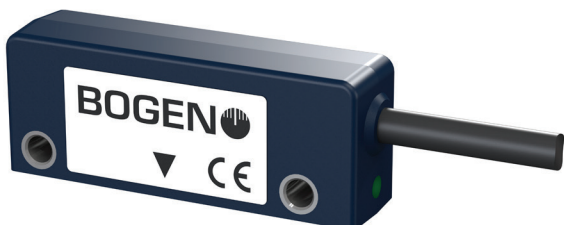




Measuring



Positioning



## IKS9 Incremental Magnetic Sensing Head

- Linear applications
- Rotary applications
- Non contact, quick position measurement

### Features

- High accuracy
- Resolution options available to 20 nm
- Programmable resolutions
- Customizable max output frequencies
- Software programmable interface
- Connector options with multiple cable lengths
- No wear from usage
- Resistant to dust, cooling lubricant emulsion, oil, etc.
- High fly height tolerance
- Unlimited measuring length

### Measuring movements with the IKS9 – more power in less space

The incremental magnetic sensing head IKS9 for linear and rotary applications:

The IKS9 impresses customers in automation, instrumentation and motion control applications with an extremely high accuracy and a particularly high degree of modularity. BOGEN offers more than 1 million different variants of IKS9 that can be configured to customer-specific requirements. In combination with an individual scale, measurement solutions for almost every application can be custom-tailored.

Features

|  |  |
|--|--|
| Resolution   | 0.020 to 1250 $\mu\text{m}$ , depending on the pole pitch  |
| Max. Movement Speed                                    | up to 100 m/s, depending on the pole pitch, resolution and Max Output Freq. (maximum movement speed of P 0.5 is 25 m/s; P 1 is 50 m/s; P 2 is 100 m/s; P 2.54 is 125 m/s and P5 250 m/s)                       |
| Energy consumption (without Load)                      | <65 mA (UB = 5 V)  |
| Operating temperature                                  | -20 to +70 $^{\circ}\text{C}$  |
| Storage temperature                                    | -20 to +80 $^{\circ}\text{C}$  |
| Protection class                                       | IP67   |
| LED <sup>(1)</sup>                                     | green LED = set up ok<br>red LED = LED Error Mode see order codes on Page 6  |
| Adjustable parameters                                  | Resolution, maximum output frequency, counting direction and interface (with optional programming device and the appropriate software)   |
| Weight   | Weight IKS9 (plastic case) ~60g (L2 T1 C4 standard quality cabel with length 2 m; connector D-SUB 15)<br>Weight IKS9.1 (metal case) ~75g (L2 T1 C4 standard quality cabel with length 2 m; connector D-SUB 15) |
| Maximum tightening torque for M3 screws <sup>(*)</sup> | 0.4 Nm (3.5 lbf in)  |

<sup>(1)</sup>For additional information please see LED Mode on Page 6

<sup>(\*)</sup>lbf in = poundforce inch

Resolution and Speed

Default Values at Output Frequency F = 1000 kHz

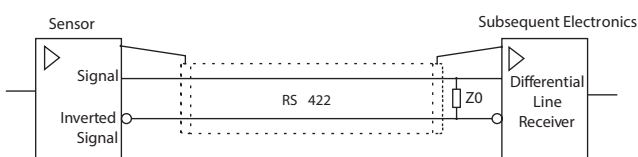
| Pole Pitch<br>P [mm] | Resolution<br>R [ $\mu\text{m}$ ] | Max. Movement Speed<br>Vmax [m/s] |
|----------------------|-----------------------------------|-----------------------------------|
| 0.5                  | 0.25                              | 1                                 |
| 1                    | 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               | V5 = 5 V $\pm$ 5 %<br>V7 = 7 - 32 V  |
| Interface (without load)     | D1 = RS422 (0 to 5 V)<br>D2 = Push-Pull HTL (0 to supply voltage)<br>D3 = Push-Pull TTL (0 to 5 V) |
| Cable length of sensing head | Standard 2 m, optional variable length from 10 cm up to 6 m  |
| Connector                    | plug according to order code, other options on request   |

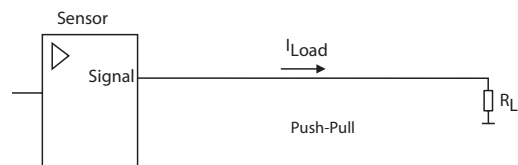
Output Circuit

RS422

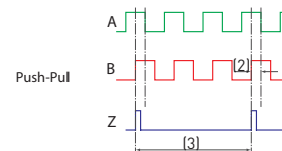
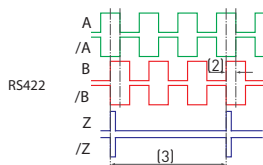


Load resistor Z0 = 120  $\Omega$  at the receiving end

Push-Pull (HTL, 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 $^{\circ}$   $\pm$ 10 $^{\circ}$  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

Further Selection (Ordering Parameters)

| Pole Pitch<br><i>P</i> [mm] |   |   |      |   | Resolution<br><i>R</i> [µm] | Resolution<br><i>Rdpi</i> [dpi] | Maximum Output Frequency per channel <i>F</i> [kHz] |       |      |      |       |        |
|-----------------------------|---|---|------|---|-----------------------------|---------------------------------|---|-------|------|------|-------|--------|
| 0.5                         | 1 | 2 | 2.54 | 5 |                             |                                 | 3500  | 1750  | 1000 | 500  | 100   | 60     |
| (0.1 inch)                  |   |   |      |   |                             |                                 | <b>Max. Movement Speed <i>Vmax</i> [m/s]</b>        |       |      |      |       |        |
|                             |   |   |      | 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 *Vmax*
- Interpolation =  $Rf / 4$

$R = P / Rf$

Resolution [dpi] *Rdpi*  
 $Rdpi = 25400 / R$

- Vmax* is limited by following formulars:
- $Vmax = 4 * F * R$
  - $Vmax = P * 50 \text{ kHz}$

LED Error Codes (Order Parameter E1)

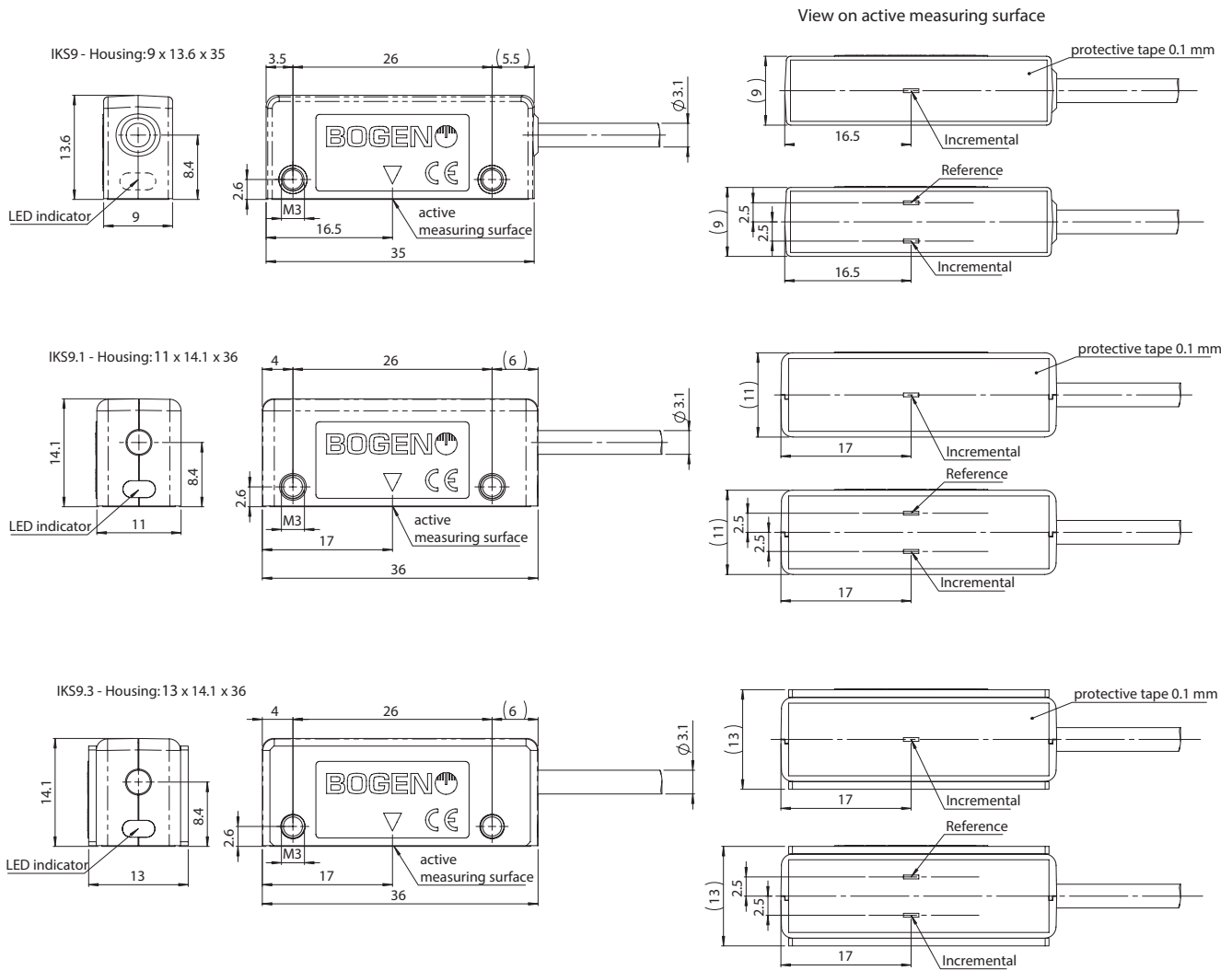
The amount of flashing signs of the red LED indicates the fault. It starts after a fast pulsed light.



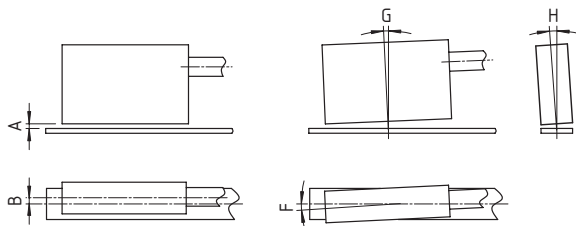
The example displays a weak and fluctuating magnetic field (fault 2 and 3).

| LED flashing signs amount | Description   |
|---------------------------|---|
| 1                         | Magnetic field is too high  |
| 2                         | Magnetic field 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



Installation Tolerances



|                       | Pole Pitch<br>0.5 mm | Pole Pitch<br>1 mm | Pole Pitch<br>2 mm | Pole Pitch<br>2.54 mm | Pole Pitch<br>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 <sup>(4)</sup> [mm] | 2.5                  | 2.5                | 2.5                | 2.5                   | 2.5                |
| B <sup>(5)</sup> [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°                 |

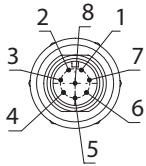
<sup>(4)</sup> relative to 10 mm scale width (1-track)

<sup>(5)</sup> relative to 10 mm scale width (2-track)

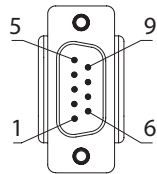
Pin Assignment

| Signal | Color  | Pin No.               |                      |                       |                         |                          |
|--------|--------|-----------------------|----------------------|-----------------------|-------------------------|--------------------------|
|        |        | C2<br>M12 plug (male) | C3<br>D-SUB 9 (male) | C4<br>D-SUB 15 (male) | C5<br>D-SUB 25 (female) | C6<br>D-SUB 15 HD (male) |
| V -    | blue   | 1                     | 9                    | 2                     | 2 + 16 <sup>(6)</sup>   | 2                        |
| V +    | red    | 2                     | 5                    | 7                     | 1 + 14 <sup>(6)</sup>   | 7                        |
| A      | brown  | 3                     | 4                    | 14                    | 3                       | 14                       |
| /A     | green  | 4                     | 8                    | 6                     | 4                       | 6                        |
| B      | grey   | 5                     | 3                    | 13                    | 6                       | 13                       |
| /B     | yellow | 6                     | 7                    | 5                     | 7                       | 5                        |
| Z      | pink   | 7                     | 2                    | 12                    | 17                      | 12                       |
| /Z     | white  | 8                     | 6                    | 4                     | 18                      | 4                        |
| Shield | -      | 1                     | Case                 | Case                  | Case                    | Case + 15                |

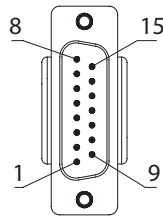
<sup>(6)</sup> PIN 1 with Pin 14 and Pin 2 with Pin 16 connected through solder bridge



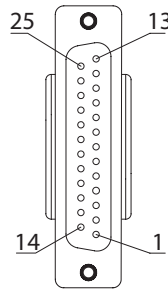
C2: M12 plug (male)



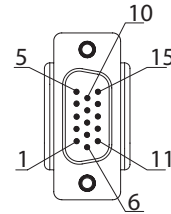
C3: D-SUB 9 (male)



C4: D-SUB 15 (male)



C5: D-SUB 25 (female)



C6: D-SUB 15 HD (male)

Optional Accessory – Order Codes for Linear Scales, 10 mm Width <sup>(7)</sup>

| Pole Pitch | Accuracy A3     | Accuracy A10     | Accuracy A20     | Accuracy A40 (standard) |
|------------|-----------------|------------------|------------------|-------------------------|
| 0.5        | KBEE10-0.5-A3K  | KBEE10-0.5-A10K  | KBEE10-0.5-A20K  | KBEE10-0.5-K            |
| 1          | KBEE10-1-A3K    | KBEE10-1-A10K    | KBEE10-1-A20K    | KBEE10-1-K              |
| 2          | KBEE10-2-A3K    | KBEE10-2-A10K    | KBEE10-2-A20K    | KBEE10-2-K              |
| 2.54       | KBEE10-2.54-A3K | KBEE10-2.54-A10K | KBEE10-2.54-A20K | KBEE10-2.54-K           |
| 5          | KBEE10-5-A3K    | KBEE10-5-A10K    | KBEE10-5-A20K    | KBEE10-5-K              |

<sup>(7)</sup> Scale dimensions: 10 mm x 1.3 mm (w/o cover tape), length up to 50 m. Other accuracies, other pole pitches, other scale widths and scales with reference track on request. See separate data sheet for linear scales for further possibilities.

Optional Accessory – Rotary Scales

See separate data sheet for rotary scales for further possibilities.

Order Code

Parameters

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

|          |  | Code <sup>(8)</sup> | Explanation <sup>(8)</sup>  |
|----------|--|---------------------|---|
| <b>W</b> | <b>Width [mm]</b>  |                     | 9 mm (Plastic case)   |
|          |  | .1                  | 11 mm (Metal case)  |
|          |  | .3                  | 13 mm (Metal case)  |
| <b>Z</b> | <b>Reference Signal <sup>(9,10)</sup></b>                        | <b>Z1.50</b>        | <b>Periodic index signal from the pole pitch, length of index signal 50 counts</b>  |
|          |  | Z1. ...             | Periodic index signal from the pole pitch, length of index signal ... counts <sup>(11)</sup>  |
|          |  | Z2. ...             | From reference marks (requires 2-track magnetic tape with incremental track and reference track), length of index signal ... counts <sup>(11)</sup> |
| <b>P</b> | <b>Pole Pitch [mm]</b>   | P0.5                | 0.5 mm (not interoperable with Z2)  |
|          |  | P1                  | 1 mm  |
|          |  | <b>P2</b>           | <b>2 mm</b>   |
|          |  | P2.54               | 2.54 mm   |
|          |  | P5                  | 5 mm  |
| <b>V</b> | <b>Supply Voltage [V]</b>  | <b>V5</b>           | <b>5 V</b>  |
|          |  | V7                  | 7...32 V (on request only)  |
| <b>D</b> | <b>Interface <sup>(9)</sup></b>                                  | <b>D1</b>           | <b>RS422</b>  |
|          |  | D2                  | Push-Pull HTL   |
|          |  | D3                  | Push-Pull TTL   |
| <b>R</b> | <b>Resolution <sup>(9,*)</sup></b>                               | R0.25               | 0.25 µm (Standard for pole pitch 0.5 mm)  |
|          |  | R0.5                | Standard for pole pitch 1 mm  |
|          |  | <b>R1</b>           | <b>Standard for pole pitch 2 mm</b>   |
|          |  | 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   |
| <b>F</b> | <b>Maximum Output Frequency per channel <sup>(9)</sup> [kHz]</b> | <b>F1000</b>        | <b>1000 kHz</b>   |
|          |  | F...                | Other non-standard output frequencies, see section "Resolution and Speed" in table 1 on page 2  |
| <b>T</b> | <b>Cable Type</b>  | <b>T2</b>           | <b>Drag chain quality (4 mm diameter)</b>   |
|          |  | T3                  | Special cable (on request)  |
|          |  | T4                  | Special cable with 3.1 mm (on request)  |
| <b>C</b> | <b>Connector (others on request)</b>                             | C2                  | M12 plug (male) (on request only)   |
|          |  | C3                  | D-SUB 9 (male)  |
|          |  | <b>C4</b>           | <b>D-SUB 15 (male)</b>  |
|          |  | C5                  | D-SUB 25 (female)   |
|          |  | C6                  | D-SUB 15 HD (male)  |
|          |  | C99                 | Customer specific connector   |
|          |  |                     |   |
| <b>L</b> | <b>Cable Length [m]</b>  | L1                  | 1 m   |
|          |  | <b>L2</b>           | <b>2 m</b>  |
|          |  | L3                  | 3 m   |
|          |  | L...                | ... m   |
|          |  | L6                  | 6 m   |
| <b>E</b> | <b>LED Mode <sup>(9)</sup></b>                                   | E0                  | LED Green: Low -> sufficient magnetic field<br>Bright -> best performance<br>LED RED: Error signalization with LED on                               |
|          |  |                     | E1  |

<sup>(8)</sup> standard parameters are bold

<sup>(9)</sup> user programmable parameters (optional IKS-Programming device necessary)

<sup>(10)</sup> if no index signal is needed, please do not connect pin "Z" an "/Z" on delivered connector

<sup>(11)</sup> length of index signal available from 1 to 256

<sup>(\*)</sup> R... for metric based pole pitches / R#... for inch based pole pitches

## Ordering Example

IKS9-Z1.50P2V5D1R1F1000T2C4L2E1  
IKS9 Magnetic Sensing Head, width 9 mm, with periodic index signal, index length 50 counts, 2 mm pole pitch, voltage 5 V, interface RS422, 1  $\mu$ m resolution, max. output frequency 1000 kHz, Drag chain quality (4 mm diameter), D-SUB 15 (male) connector, cable length 2 m, error signalization with blinking error codes

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IKS9.1-Z2.1P5V7D3R125F100T2C5L5.5E0  
IKS9 Magnetic Sensing Head, width 11 mm, with reference signal from reference marks (2-track magnetic tape), index length 1 count, 5 mm pole pitch, voltage 7-32 V (broad-range), interface Push-Pull TTL, 125  $\mu$ m resolution, max. output frequency 100 kHz, Drag chain quality (4 mm diameter), D-SUB 25 (female) connector, cable length 5.5 m, error signalization with LED RED on

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

IKS9.1-Z2.50P2V5D1R0.244140625F3500T4C4L0.3E1  
IKS9 Magnetic Sensing Head, width 11 mm, with reference signal from reference marks (2-track magnetic tape), index length 50 count, 2 mm pole pitch, voltage 5 V, interface RS422, 0.244140625  $\mu$ m resolution, max. output frequency 3500 kHz, special cable with 3.1 mm, D-SUB 15 (male) connector, cable length 0.3 m, error signalization with blinking error codes

IKS9.3-Z1.1P2V5D1R15.625F2333T4C6L0.6E1  
IKS9 Magnetic Sensing Head, width 13 mm, with periodic index signal, index length 1 count, 2 mm pole pitch, voltage 5 V, interface RS422, 15.625  $\mu$ m resolution, max. output frequency 2333 kHz, special cable with 3.1 mm, D-SUB 15 HD (male) connector, cable length 0.6 m, error signalization with blinking error codes