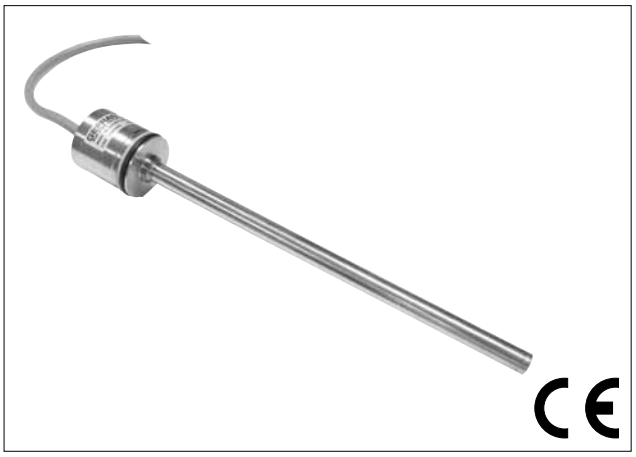
GEFRAN

# RK-2

*CONTACTLESS MAGNETOSTRICTIVE LINEAR POSITION TRANSDUCER WITH FLANGED HEAD* *(ANALOG OR START/STOP OUTPUT)*



### *Main characteristics*

- *Absolute transducer*
- *Strokes from 50 to 4000mm (RK-2-_ _ _ _ -N/E/S)*
- *Digital output RS422 Start/Stop (RK-2-_ _ _ _ -S)*
- *Direct analog output (RK-2-_ _ _ _ -N/K/E)*
- *Operating temperature: -30...+90°C*
- *Resistance to vibration (DIN IEC68T2/6 20g)*
- *Power supply 18Vdc...30Vdc*
- *Optional 12Vdc power supply (RK-2-_ _ _ _ -K)*
- *The digital version (RK-2-_ _ _ _ -S) allows the remote connection (max. 50 m) of optional electronics for use of advanced analog (EKA) or CANopen (EKC) interfaces*

Contactless linear position transducer with magnetostrictive technology: the absence of electrical contact on the cursor eliminates problems of wear and consumption and guarantees almost unlimited life.
The head's flanged shape and small size make the RK-2 series ideal for applications requiring installation completely inside the hydraulic cylinder.
The overall dimensions of the sensor are among the smallest available on the market.
For the interface signal, you can choose between a start/stop interface (which allows the use of multiple cursors) and an analog interface that gives the displacement of a single cursor (available in the several ranges in Voltage or Current).
Excellent linearity, repeatability, resistance to mechanical vibrations and shocks complete the product's specifications overview.

## TECHNICAL DATA

| | |
|---|---|
| Model | from 50 to 4000 mm (max. 1250 mm RK-2-_ _ _ _-K) |
| Measurement taken | Displacement |
| Position read sampling time (typical) | 1 ms |
| Shock test DIN IEC68T2-27 | 100g, 11ms single shock |
| Vibrations DIN IEC68T2-6 | 20g, 10...2000Hz |
| Displacement speed | ≤10 m/s |
| Max. acceleration | ≤ 100 m/s² displacement |
| Resolution | Infinite, limited by noise (10$\mu$m) |
| Working pressure | 350 bar (peak max 500 bar) |

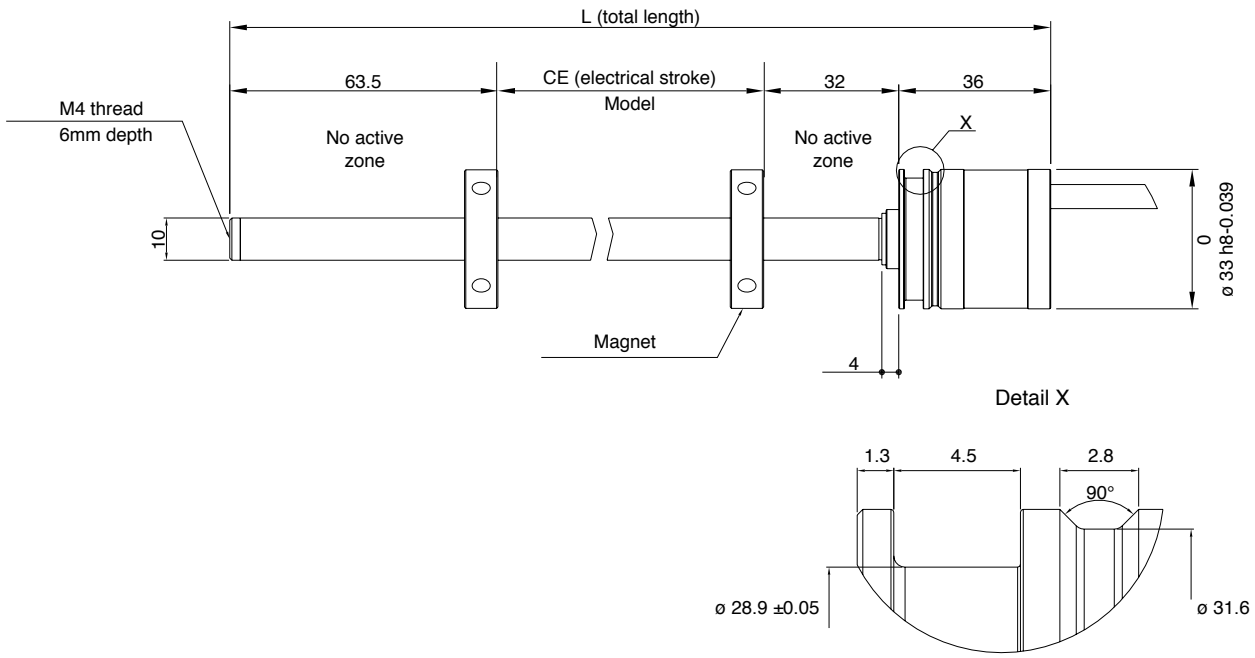
## ELECTRICAL DATA

| | |
|---|---|
| Nominal power supply | 18...30Vdc<br>opt. 12Vdc (RK-2-_ _ _ _-K) |
| Max. power ripple | 1Vpp |
| Output signal | Start/Stop (RK-2-_ _ _ _ -S)<br>0.1...10.1Vdc (RK-2-_ _ _ _ -N)<br>0.1...5.1Vdc (RK-2-_ _ _ _ -K)<br>4...20mA (RK-2-_ _ _ _ -E) |
| Max. analog output load | 5KΩ |
| Output current consumption | max 40 mA<br>(load on start/stop output: 300 Ω) |
| Electric isolation | 100 Vdc |
| Protection against polarity inversion | Yes |
| Protection against overvoltage | Yes |

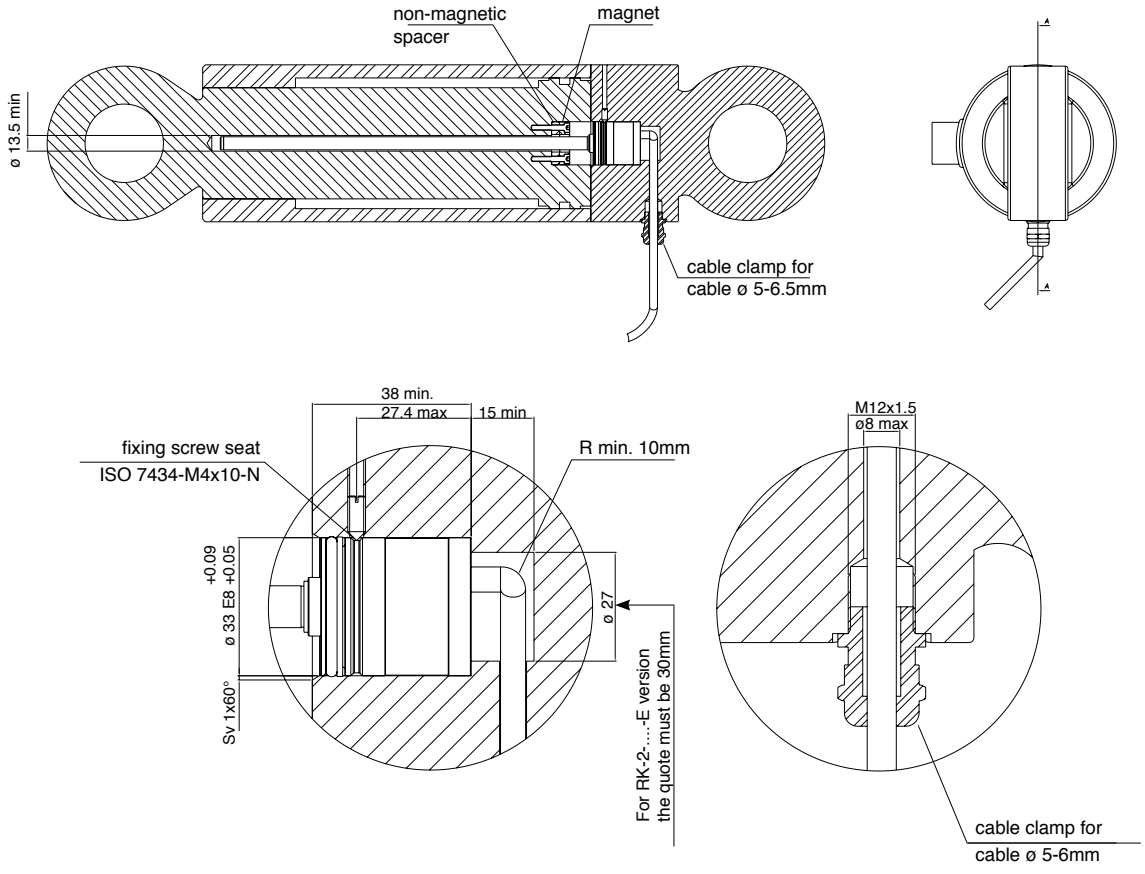
## ENVIRONMENTAL DATA

| | |
|---|---|
| Protection in hydraulic circuit area | IP 67 |
| Operating temperature | -30°…+90°C for strokes ≤ 2500 mm and power supply ≤ 24 Vdc<br>otherwise -30...+70°C |
| Storage temperature | -40°…+100°C |
| Coefficient temperature | 0.005% FS / °C |

## MECHANICAL DIMENSIONS



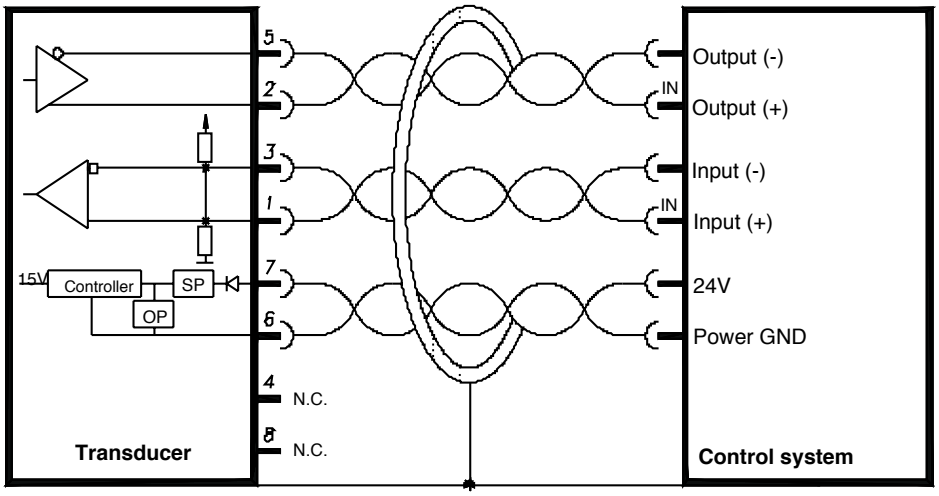

## MOUNTING INSIDE A CYLINDER



## ELECTRICAL / MECHANICAL DATA

| Model | | 50 | 100 | 130 | 150 | 200 | 225 | 300 | 400 | 450 | 500 | 600 | 700 | 750 | 800 | 900 | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2750 | 3000 | 3250 | 3500 | 3750 | 4000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Electrical stroke (C.E.) | mm | **Model** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Independent linearity | | < ± 0.02% F.S. (Min. ± 0.060 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Max. dimensions (L) | mm | **Model +** 131.5 (excluding cable) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Repeatability | mm | < 0.01 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hysteresis | | < ± 0.005% F.S. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sampling time | msec | **1** (**1.5** for strokes from 1100 to 2000) (**2** for strokes from ≥2000) | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## ELECTRICAL CONNECTIONS (RK- 2 - _ _ _ _ - S)




| RK-2-_ _ _ _ -S | Cable |
|---|---|
| Output (+) | Gray |
| Output (-) | Green |
| Input (+) | Yellow |
| Input (-) | Pink |
| Power supply + | Brown |
| Power supply GND | Blue |

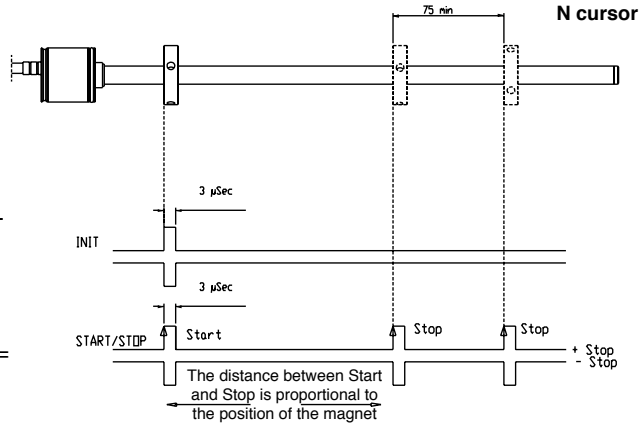
## ELECTRICAL CONNECTIONS (RK- 2 - _ _ _ _ - N/K/E)

| RK-2-_ _ _ _ -N | RK-2-_ _ _ _ -K | RK-2-_ _ _ _ -E | Cable |
|---|---|---|---|
| Output 0.1...10.1Vdc | Output 0.1...5.1Vdc | Output 4...20mA | Yellow |
| Output GND | Output GND | Output GND | Pink |
| Power supply + | Power supply + | Power supply + | Brown |
| Power supply GND | Power supply GND | Power supply GND | Blue |

**IMPORTANT**: in case of cable lenggth shortening, after cutting the cable take care of soldering and insulating the green and grey wires together

## DIGITAL OUTPUT RK- 2 - _ _ _ _ - S

Series RK-2-_ _ _ _ -S magnetostrictive transducers supply digital outputs in START/STOP format with RS422 differential serial transmission.
The transducer requests an Initialisation pulse that launches sampling. The following pulses are transmitted on the outputs:
**Start**: the Initialisation pulse retransmitted
**Stop**: the pulse corresponding to the position of each magnet.
The time between the Start pulse and the subsequent Stop pulses is proportional to the position of each magnet according to the "Magnetostrictive wave propagation speed" constant, equal to about 2900 m/Ssec.




P= Time * 2900m/Sec

The correct propagation speed for each product is shown on the product label.
Resolution in terms of metres is linked to the resolution used to measure time

1 $\mu$Sec (1MHz ) ==> 2.9 mm
10 nSec (100 MHz ) ==> 0.029mm
1 nSec (1GHz ) ==> 2.9 $\mu$m

The measurement reference is the leading edge of the pulse.
Optimum width of the interrogation pulse is 3$\mu$Sec, but the transducer works correctly for times from 1.5 to 5$\mu$Sec

## ORDER CODE

**Position transducer** R K 2 ☐ ☐ ☐ ☐ ☐

0 0 0 0 X 0 0 0 X ☐ ☐ X 0 X X

**Model**

**Output**

| | | |
|---|---|---|
| Start/Stop | Start/Stop interface | **S** |
| Analog | 0.1...10.1Vdc interface (power supply 18...30Vdc) | **N** |
| Analog | 0.1...5.1Vdc interface (power supply 12Vdc) | **K** |
| Analog | 4...20mA interface (power supply 18...30Vdc) | **E** |

**Connection cable to remote element (PUR)**

**00** = 1 mt **02** = 2 mt **03** = 3 mt
**04** = 4 mt **05** = 5 mt **10** = 10 mt
**15** = 15 mt

Mechanical and/or electrical characteristics differing from those in the standard version may be arranged on request.

## FLOATING CURSOR (to order separately)

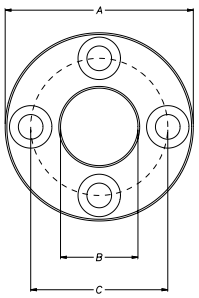
P C U R ☐ ☐ ☐

**Cursors**

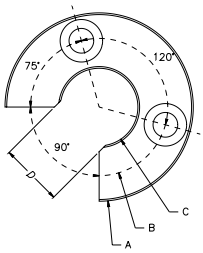
| | |
|---|---|
| Cursor diameter 32.8 | **022** |
| Cursor diameter 32.8 with 90° slit | **023** |
| Cursor diameter 25.4 | **024** |

| Dimensions | A | B | C | Thickness |
|---|---|---|---|---|
| PCUR022 | 32.8 | 13.5 | 23.9 | 7.9 |
| PCUR023 | | | | |
| PCUR024 | 25.4 | 13.5 | - | |

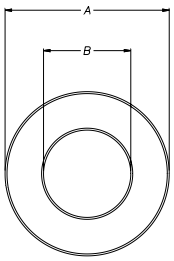
**PCUR022**




**PCUR023**




**PCUR024**




The **PCUR022** is supplied with:

N° 8 Brass nuts M4
N° 8 Brass washers D4
N° 4 Brass screws M4x25

The **PCUR023** is supplied with:

N° 4 Brass nuts M4
N° 4 Brass washers D4
N° 2 Brass screws M4x25

## OPTIONAL ACCESSORIES (to order separately)

| | |
|---|---|
| Cable clamp | **PRE060** |

## OPTIONAL REMOTE ELECTRONICS FOR RK-2- _ _ _ _ -S

### Available in two versions

- With analog voltage or current output for displacement and speed measurement (model EKA)
- With CANopen DS-301 V4.01 Device Profile DS-406 V2.0 interface (model EKC)

### Main features

- Option for zero and full-scale adjustment over 100% of the stroke via “magnetic pen” (available on model EKA)
- Power range 10...30Vdc
- Connection to remote electronics via connector or screw terminal (PUR cable, ø 5 mm)
- MAX distance of remote electronics from sensor: 50 m

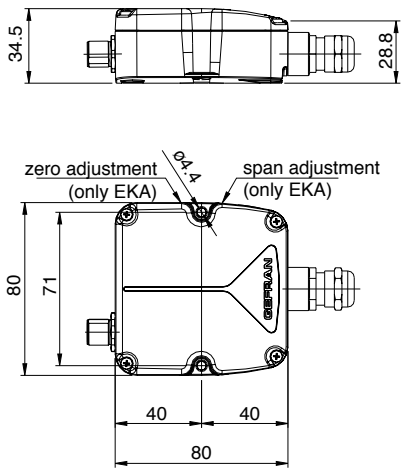
## TECHNICAL DATA (EKA)

| | | |
|---|---|---|
| Measurement taken | Displacement / Speed | |
| Speed range | 0.1 ... 10 m/s | |
| Accuracy speed | < 2 % (in all F.S.) | |
| Speed calculation time | Sampling time + 500$\mu$sec | |
| Resolution | 16 bit | |
| Output signal | 0...10V (N,P)<br>0...5V (K) | 4...20mA (E,F)<br>0...20mA (B,C) |
| Nominal power supply | 10...30Vdc | 10...30Vdc |
| Max. power ripple | 1Vpp | 1Vpp |
| Current consumption | Depends on power supply voltage:<br>max 70mA with power supply of 30Vdc *<br>max 85mA with power supply of 24Vdc *<br>max 110mA with power supply of 18Vdc **<br>max 200mA with power supply of 10Vdc **<br><br>* peak 0.2A at power<br>** peak 0.4A at power | |
| Output load | 2 KΩ | < 500 Ω |
| Max. output ripple | < 5 mV pp | < 5 mV pp |
| Max. output value | 10.6 V | 25 mA |
| Electrical isolation | 200 V | 200 V |
| Protection against polarity inversion | YES | YES |
| Protection against overvoltage | YES | YES |
| Self-resetting internal fuse | YES | YES |

## TECHNICAL DATA (EKC)

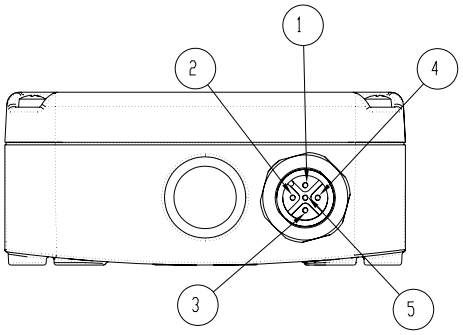
| | |
|---|---|
| Measurement taken | Displacement / Speed |
| Displacement resolution | 5 $\mu$m (2 $\mu$m on request) |
| Speed resolution | Up to 0.01 mm/sec |
| Speed calculation time | Sampling time + 500 $\mu$sec |
| Output signal | CANopen digital commuication |
| Nominal power supply | 10...30Vdc |
| Max. power ripple | 1V pp |
| Current consumption | Depends on power supply voltage:<br>max 70mA with power supply of 30Vdc *<br>max 85mA with power supply of 24Vdc *<br>max 110mA with power supply of 18Vdc **<br>max 200mA with power supply of 10Vdc **<br><br>* peak 0.2A at power<br>** peak 0.4A at power |
| Electrical isolation | 200V |
| Protection against polarity inversion | YES |
| Protection against overvoltage | Varistors on power supply line |
| Overcurrent protection | PTC (internal self-resetting fuse on power supply line) |

## MECHANICAL DIMENSIONS

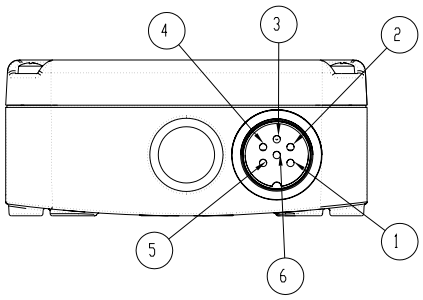


## ELECTRICAL CONNECTIONS

**RK-_-_ _ _ _-S-EKA- _ -M-_ - _**
**RK-_-_ _ _ _-S-EKC- _ -M-_ - _**




**RK-_-_ _ _ _-S-EKA- _ -B-_ - _**
**RK-_-_ _ _ _-S-EKC- _ -B-_ - _**



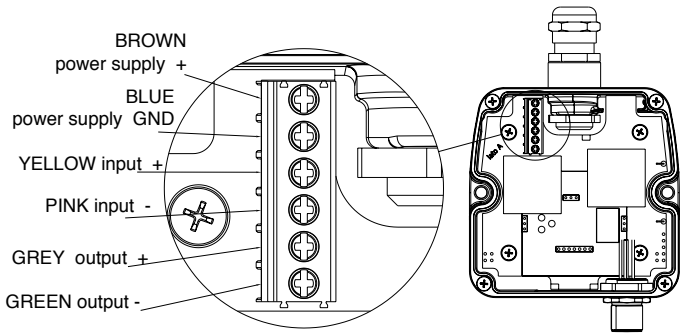

| Function | EKA-_-M-_-_ M12 5-pin | EKA-_-B-_-_ M16 6-pin DIN 45322 | Optional cable for M12 |
|---|---|---|---|
| **Output 1 (displacement)**<br>0...10V<br>0...5V<br>4...20mA<br>0...20mA | 1 | 1 | Brown |
| **GND shift 1**<br>(0V) | 2 | 2 | White |
| Output 2<br>(reverse displacement, or speed depending on the model)<br>0...10V<br>0...5V<br>4...20mA<br>0...20mA | 3 | 3 | Blue |
| **GND shift 1/2**<br>(0V) | 2 | 4 | White |
| **Power supply +** | 5 | 5 | Grey |
| **Power supply -** | 4 | 6 | Black |

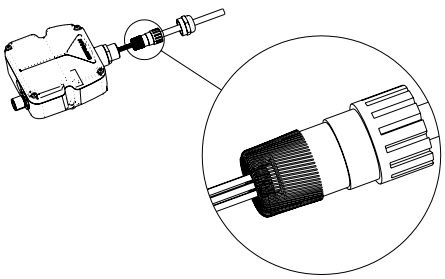
| Function | EKC-_-M-_-_ M12 5-pin | EKC-_-B-_-_ M16 6-pin DIN 45322 | Optional cable for M12 |
|---|---|---|---|
| CAN L | 5 | 1 | Grey |
| CAN H | 4 | 2 | Black |
| n.c. | 1 | 3 | Brown |
| n.c. | - | 4 | - |
| **Power supply +** | 2 | 5 | White |
| **Power supply -** | 3 | 6 | Blue |

## INTERCONNECTION BETWEEN PRIMARY SENSOR AND REMOTE ELECTRONICS

**RK- _ - _ _ _ _ - S-EKA - _ - _ - R - _**
**RK- _ - _ _ _ _ - S-EKC - _ - _ - R - _**

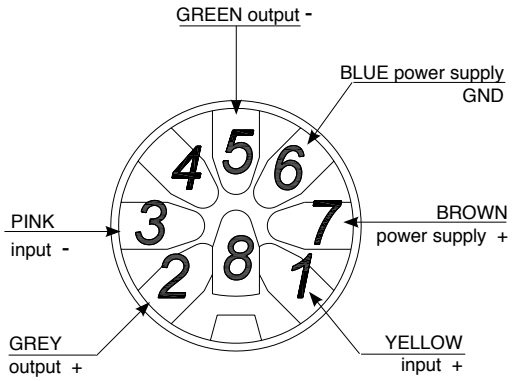
(interconnection with wire clamp and screw terminals)



**RK- _ - _ _ _ _ - S-EKA - _ - _ - M - _**
**RK- _ - _ _ _ _ - S-EKC - _ - _ - M - _**

(interconnection with M12 8-pin connector)




**Attention**:
do all wiring BEFORE powering the electronics
(i.e., with unit off).

## CALIBRATION WITH MAGNETIC PEN (option RK- _ - _ _ _ _ -S-EKA-D- _ - _ - _)

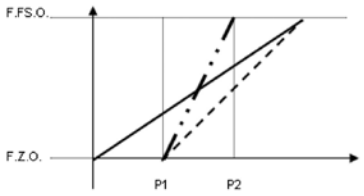
The magnetic pen is needed to calibrate the useful stroke of the transducer in a manner other than as configured in the factory (default).

• **CALIBRATION OF ZERO POINT**
when the magnet is at the required zero point, position the magnetic pen in the ZERO zone for a time between 0.5 and 10 seconds.

• **CALIBRATION OF FULL-SCALE POINT**
when the magnet is at the required full-scale point, position the magnetic pen in the FS zone for a time between 0.5 and 10 seconds.

• **SAVING THE NEW CALIBRATION**
position the magnetic pen in the ZERO or FS zone for a time between 10 and 60 seconds. The programmed configuration will be saved and active at the next power-up.

• **RESTORING FACTORY DEFAULT CALIBRATION**
position the magnetic pen in the ZERO or FS zone for more than 60 seconds. This will restore the original factory calibration in the internal EEPROM.




Factory

Zero button with Magnet in P1

FS button with magnet in P2

F.Z.O: 0V, 4mA, 0mA, -10V, -5V

F.F.S.O: 10V, 20mA, 0mA, +10V, +5V

## ORDER CODE (RK-2 with EKA analog remote electronics)

**Position transducer** R K 2 _ _ _ _ S - E K A _ _ _ _ 0 0 0 0 X _ _ _ _ _ _ X 0 X X

**Model**

| | |
|---|---|
| Analog output | **A** |
| Analog output with zero and span setting | **D** |

**Output connector type**

| | |
|---|---|
| M12, 5-pin connector output | **M** |
| DIN 45322 6-pin connector output | **B** |

**Type of connection to the primary sensor**

| | |
|---|---|
| Internal screw terminal | **R** |
| M12, 8-pin connector | **M** |

**Output**

| | | |
|---|---|---|
| 0...10Vdc | 1 Cursor, double output position (standard) | **N** |
| 0...10Vdc | 1 Cursor, position and speed | **P** |
| 4...20mA | 1 Cursor, double output position | **E** |
| 4...20mA | 1 Cursor, position and speed | **F** |

**Available on request**

| | | |
|---|---|---|
| 0...20mA | 1 Cursor, double output position | **B** |
| 0...20mA | 1 Cursor, position and speed | **C** |
| 0...+5Vdc | 1 Cursor, double output position | **K(*)** |

**(*)** The maximum stroke for the K version is 1200mm

**Output of speed**

Only for analogic output option C, F, P

Max. measurable speed: 0.1 ÷ 10.0 m/s

| | |
|---|---|
| **00.0** | Function not required |

**Power supply**

| | |
|---|---|
| **S** | 10...30V (standard) |

**Connection cable to remote element**

**00** = 1 mt **02** = 2 mt **03** = 3 mt
**04** = 4 mt **05** = 5 mt **10** = 10 mt
**15** = 15 mt

Mechanical and/or electrical characteristics differing from those in the standard version may be arranged on request.

## ORDER CODE (RK-2 with EKC CANopen remote electronics)

**Position transducer**

| R | K | 2 | | | | | S | - | E | K | C | A | | | | 0 | 0 | 0 | 0 | | | | | | | | X | 0 | X | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Model**

**Output connector type**

| | |
|---|---|
| M12, 5-pin connector output | **M** |
| DIN 45322 6-pin connector output | **B** |

**Type of connection to the primary sensor**

| | |
|---|---|
| Internal screw terminal | **R** |
| M12, 8-pin connector | **M** |

Type (see table 1)

Transmission speed (see table 2)

**System resolution**

| | |
|---|---|
| **1** | 0.002 mm |
| **2** | 0.005 mm (standard) |
| **3** | 0.010 mm |
| **4** | 0.020 mm |
| **5** | 0.040 mm |

**Programming node number**

| | |
|---|---|
| **XXX** | Standard; node = 127 |
| **nnn** | Node specified by customer |

**Power supply**

| | |
|---|---|
| **S** | 10...30V (standard) |

**Connection cable to remote element**

**00** = 1 mt **02** = 2 mt **03** = 3 mt
**04** = 4 mt **05** = 5 mt **10** = 10 mt
**15** = 15 mt

**Termination resistance**

| | |
|---|---|
| **0** | Without resistance |
| **1** | Resistance 120Ω |

**Table 1**

| Type | N. cursors | PD01 | PD02 | PD03 | PD04 |
|---|---|---|---|---|---|
| A | 1 | Displacement<br>Speed<br>Cams | No data | No data | No data |
| B | 2 | Displacement 1<br>Speed 1<br>Cams 1 | Displacement 2<br>Speed 2<br>Cams 2 | No data | No data |

Displacement = 4 Byte - Speed = 2 Byte - Cams = 1 Byte

**Tabella 2 - velocità di trasmissione**

| | |
|---|---|
| 1 = 1 Mbaud | 6 = 100 kBaud |
| 2 = 800 kBaud | 7 = 50 kBaud |
| 3 = 500 kBaud | 8 = 20 kBaud |
| 4 = 250 kBaud | 9 = 10 kBaud |
| 5 = 125 kBaud | |

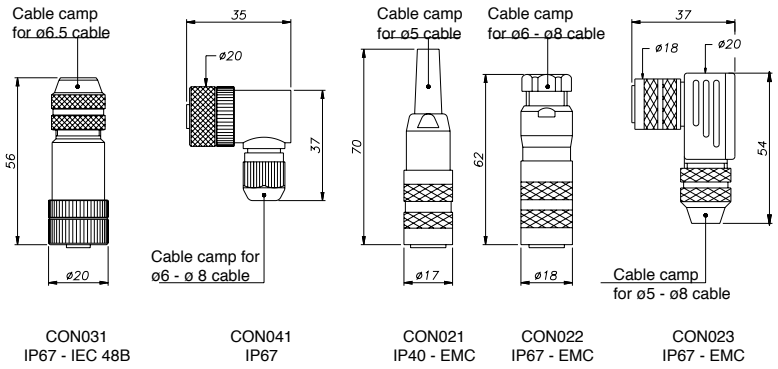
Mechanical and/or electrical characteristics differing from those in the standard version may be arranged on request.

## OPTIONAL CONNECTORS FOR EKA and EKC OUTPUT (to order separately)

For M outputs, M12 thread connector
(for RK-_-_ _ _ _-S-EKA-_-M-_-_)
(for RK-_-_ _ _ _-S-EKC-_-M-_-_-_)
Code: **CON031** 5-pin
**CON041** 5-pin

For B outputs, M16 thread connector
(for RK-_-_ _ _ _-S-EKA-_-B-_-_)
(for RK-_-_ _ _ _-S-EKC-_-B-_-_-_)
Code: **CON021** 6-pin
**CON022** 6-pin
**CON023** 6-pin

Connector extraction length: 10mm




CON031 IP67 - IEC 48B | CON041 IP67 | CON021 IP40 - EMC | CON022 IP67 - EMC | CON023 IP67 - EMC

## OPTIONAL CABLES FOR EKA and EKC OUTPUT (to order separately)

| **Cable code (for RK-_-_ _ _ _-S-EKA-_-M-_-_-_) (for RK-_-_ _ _ _-S-EKC-_-M-_-_-_)** | | | |
|---|---|---|---|
| Length "L" | | CODE | |
| | | Straight cable | Cable to 90° |
| 2 | mt | **CAV011** | **CAV021** |
| 5 | mt | **CAV012** | **CAV022** |
| 10 | mt | **CAV013** | **CAV023** |
| 15 | mt | **CAV015** | **CAV024** |

## OTHER ACCESSORIES FOR USE WITH EKA and EKC (to order separately)

M12, 8-pin axial male connector
for interconnection.....**CON460**

Magnetic pen to calibrate
remote electronic (model EK-A-D)..... **PKIT312**

The EDS file can be downloaded from www.gefran.com

Sensors are manufactured in compliance with:
- EMC 2004/108/CE compatibility directive
- RoHS 2002/95/CE directive

Electrical installation requirements and Conformity certificate are available on our web site: www.gefran.com



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