

Displacement Transducers

Displacement Transducers



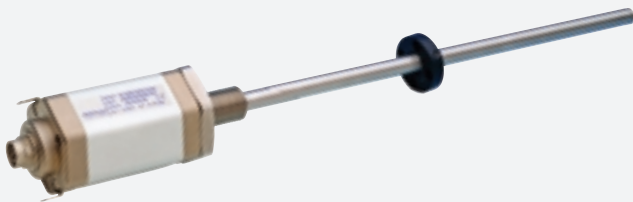
GEFRAN

Our Knowhow,
Your Solution.

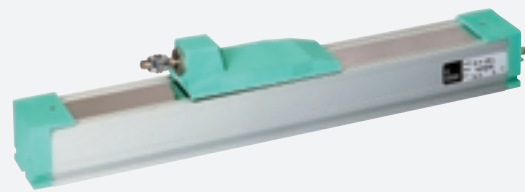
Gefran displacement transducers: reliability, precision, simple and quick installation

Gefran has designed and produced displacement sensors for over 15 years. Over a million installed transducers and in-depth knowledge of processes to be measured guarantee top performance and an excellent quality/price ratio.

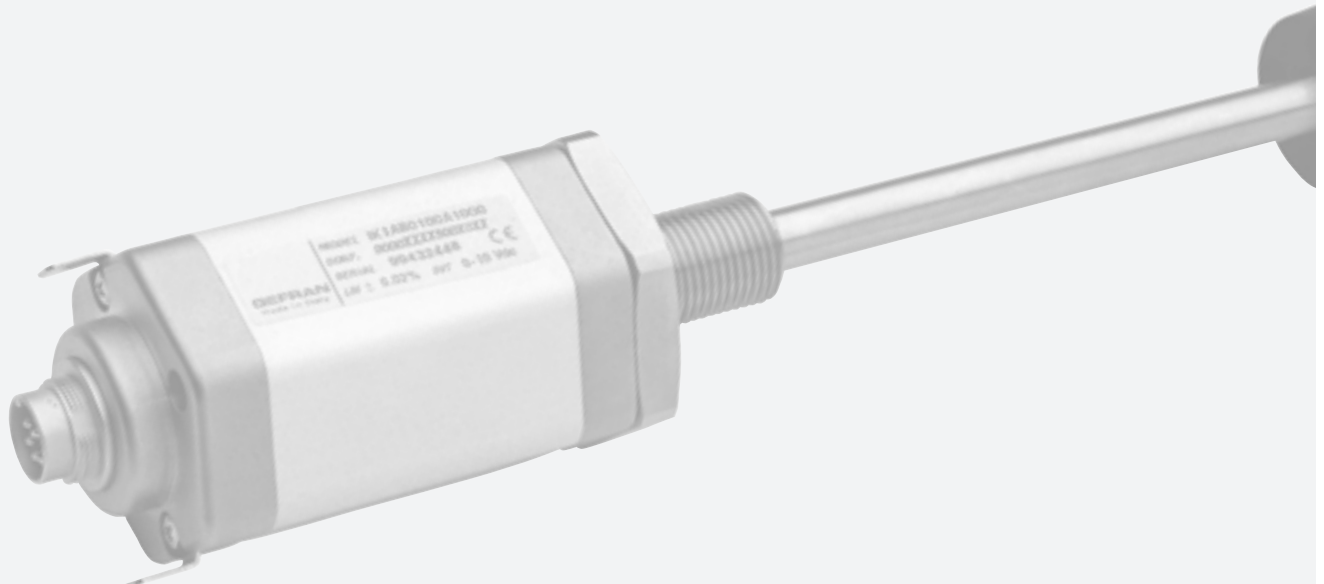
- Measurement of absolute position: when the system is switched on, the transducer immediately gives the real position without having to run mechanical repositioning.
- Life: from 100 million strokes of potentiometric transducers to practically unlimited for magnetostrictive transducers, thanks to the lack of contact between the transducer and the cursor.
- High resolution of output signal: from practically infinite for potentiometers to 2μ for magnetostrictive transducers.
- Easy installation and simple connection to most commercially available instruments and PLCs.
- Ability to simultaneously control multiple cursors with the same transducer and provide shift speed (MK4/IK4-C in CANopen and MK4/IK2P in Profibus from 1 to 4 cursors. Analog MK4-A up to a maximum of two cursors. Multicursor in digital model MK4-D Start&Stop).
- Sensors guaranteed up to 5 years (model MK4)



IK



PK



Potentiometric technology

The main element of the potentiometer consists of 2 linear tracks, with length equal to the maximum stroke of the displacement to be measured, made of a conductive material.

A mobile cursor with two brushes connected to each other serves as a bridge between the two tracks and measures the difference in potential between the first track (resistive) and the second track (conductive).

The cursor may be outside the device (and therefore connectable directly to the moving object whose displacement is to be measured) or inside. In this case, a rod is used as an actuator of the outside movement on the potentiometer cursor.

The resistive track must be of high quality to guarantee highly precise measurement: only in this way can an accurate and repeatable output voltage level correspond to the contact position on the track.

Gefran produces all the resistive tracks for its potentiometric transducers in-house, and therefore guarantees reliable, precise measurement.

Even if its tracks are developed and produced with the aim of guaranteeing accuracy, Gefran still runs a series of linearity tests.

The relative simplicity of this technology allows it to be used in compact models. Gefran potentiometers require no control logic, and are therefore quick and easy to install.

Glossary:

- linearity: the maximum percentage difference (error) between the straight line representing the theoretical output curve and the actual output curve of the transducer



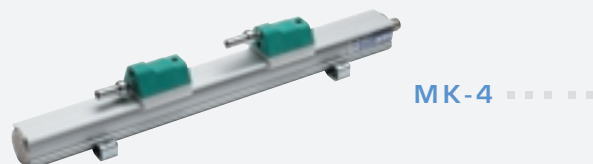
Magnetostrictive technology

The new generation of potentiometric transducer is the magnetostrictive displacement transmitter, in which there is no contact between the transducer and the mobile cursor.

The measurement element, a copper wire passing through a special alloy tube, measures the interaction between mechanical waves and electromagnetic fields.

A current pulse is transmitted along the tube from the sensor head; interaction between the current pulse and the magnetic field generated by the displacement magnet creates torsion that is transmitted along the wave-guide rod in the form of a mechanical wave. By measuring the time between transmission of the first signal and detection of torsion on the rod, you can calculate the exact position of the magnet.

There is no direct contact between moving parts, so the transducer is not subject to wear. This also guarantees greater precision and repeatability.



GUIDE TO CHOOSING THE BEST TRANSDUCER

STROKE LENGTH

GEFRAN potentiometric and magnetostrictive transducers measure linear displacement on strokes from a minimum of 10 mm to a maximum of 4000 mm. It is important to remember that two strokes are usually specified:

- Mechanical stroke: the actual shift of the transducer cursor;
 - Useful electrical stroke: the part of the mechanical stroke on which transducer linearity is guaranteed.
- This means that when studying the application, you have to choose a transducer with a useful electrical stroke greater than or equal to the maximum shift of the moving part.

TYPES OF ACTUATORS

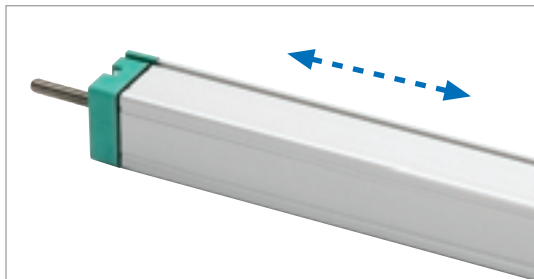
To detect the shift of an object, the transducer has a mobile part that is normally attached to the object itself.

This mobile part is usually one of two types:

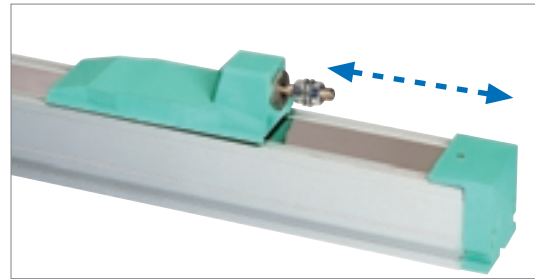
- rod: this is the traditional system used by potentiometers, and consists of a rod inserted in the transducer body and transmits the shift to the interior of the sensor;
- cursor: this system permits more compact solutions thanks to the use of a cursor attached to the moving part to be measured.

It is available on some potentiometers (series PK, PME and PMI) and on most magnetostrictives.

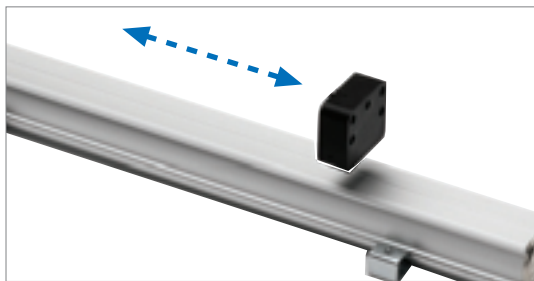
Note that the cursor can be guided (slide or ring) or completely free from the transducer (floating cursor).



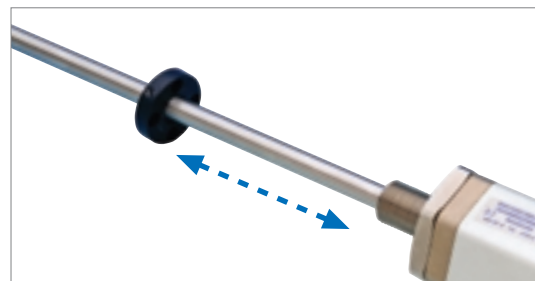
LT



PK



MK



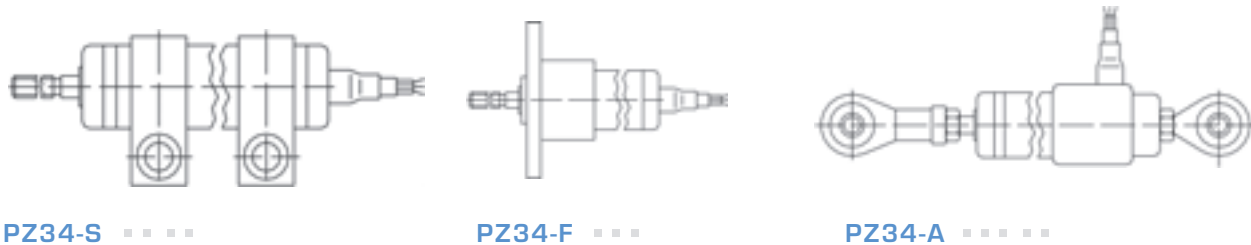
IK

INSTALLATION

The transducer can be installed on three types of supports:

- brackets: the traditional method; requires a free surface for installation and uses two or more brackets based on the length of the transducer;
- flanges: ideal in applications in which the rod has to pass through a hole and the transducer has to be attached to the walls of the hole; in this case, you have to pay careful attention to conditions of use, especially in case of long strokes;
- self-aligning joints: these are used to attach the ends of the transducer directly to the moving parts; it eliminates other attachment points and allows measurement of unaligned movements; this system is unsuitable for very long strokes.

TECHNICAL DRAWINGS - WITHOUT POSITIONS



PROTECTION LEVEL

Depending on their structure and technology, GEFTRAN linear displacement transducers guarantee different levels of protection against dust and liquids. You can choose within a range of IP40 to IP68, as shown on the following table:

EQUIVALENCE TABLE - PRODUCTS / IP LEVEL

| IP40 | IP60 | IP65 | IP67 | IP68 |
|------|------|------|----------------|------|
| PK | LT | LT | RK - RKA - RKC | IC |
| PA1 | PZ12 | PC | MK4 | PMI |
| PY1 | PZ34 | PR65 | IK1-IK2-IK4 | |
| PY2 | | | PME | |
| PY3 | | | PMA | |
| PS | | | LT67 | |
| | | | PC67 | |
| | | | PZ67 | |

COMMUNICATION INTERFACE

Potentiometers supply a ratiometric output in voltage. This means that the output voltage range depends on the voltage used to feed the transducer.

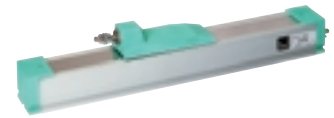
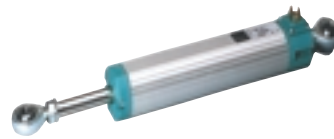
ATTENTION! The potentiometer must NOT be used as a variable resistance.

If you want a 0..10 VDC or 4..20 mA conditioned signal as a potentiometer output, you can connect a PCIR conditioner to the device output.

Magnetostrictive transducers let you choose the most appropriate output interface for the application:

- analog output in voltage:
0..5 VDC/5..0 VDC, 0..10 VDC/10..0 VDC, ± 5 VDC, ± 10 VDC
- analog output in current:
0..20 mA, 4..20 mA
- digital output:
start/stop (multicursor), PWM (monocursor)
- SSI output:
16, 21, 24, 25 bit in binary or Gray code
- CANopen output:
CiA DP 3.01 rel.4.0 and DS406
- Profibus output:
DPVO on RS485

SHORT STROKES



MODEL

LT

PC

PK

USEFUL ELECTRICAL STROKE RANGE

50..900 mm

50..750 mm

100..2000 mm

INDEPENDENT LINEARITY

± 0.05%

± 0.05%

± 0.05%

RESOLUTION

Infinite

Infinite

Infinite

WORK TEMPERATURE RANGE

-30..+100°C

-30..+100°C

-30..+100°C

MAXIMUM DISPLACEMENT SPEED

10 m/sec

5 m/sec

10 m/sec

PROTECTION LEVEL

IP60 (model -S)
IP65 (model -P)

IP65

IP40

ACTUATOR

Rod

Rod

Sliding cursor

INSTALLATION

Brackets
(variable distances between
centers)

Self-aligning joints

Brackets
(variable distances between
centers)

APPLICATIONS

High resolution
(0.01 mm) and reliability in
measurement and control
applications, even under
harsh conditions.
Brackets allow installation
in most appropriate
position.

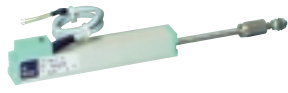
The best solution for
mechanical applications and
vehicle development,
automation and robotics,
thanks to its sturdiness and
accuracy.

The absence of a rod lets
the cursor be used along
the axis, eliminating
problems linked to the
“pump” effect so that
longer strokes can be
reached.

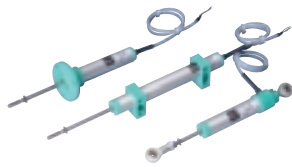
INJECTION PRESSES
HYDRAULIC PRESSES
SANDERS

BENDERS
SANDERS
EARTH MOVING

INJECTION PRESSES
WOODWORKING



PA1



PZ12



PZ34

25..150 mm

25..250 mm

25..300 mm

± 0.2% on 25
± 0.1% from 50 to 100
± 0.05% from 125 to 150

± 0.2% on 25
± 0.1% from 50 to 100
± 0.05% from 125 to 250

± 0.2% on 25
± 0.1% from 50 to 100
± 0.05% from 125 to 300

Infinite

Infinite

Infinite

-30..+100°C

-30..+100°C

-30..+100°C

5 m/sec

10 m/sec

10 m/sec

IP40

IP60
(on request: IP65)

IP60
(on request: IP65)

Rod

Rod

Rod

1 Brackets
(variable distances between
centers)

Brackets (model -S)
Joints (model -A)
Flange (model -F)

Brackets (model -S)
Joints (model -A)
Flange (model -F)

Compact. A joint provides greater tolerance in movement. Reliable even at high speeds or if subject to impact and vibration.

Problems traditionally associated with rotative potentiometers (especially reliability, life, accuracy and speed) are eliminated. The ability to attach joints provides error-free operation even in case of misalignment between transducer axis and direction of movements.

BENDERS
SANDERS
TRANSFER MACHINES

GLASS WORKING AND CUTTING
GEOTECHNICAL TEST AND INSPECTION MACHINES

HIGH IMPERMEABILITY



PME12

PMI12

PMA12

IC

50..1000 mm

50..1000 mm

50..1000 mm

100..550 mm

± 0.1% from 50 to 100
± 0.05% from 150 to 1000

± 0.1% from 50 to 100
± 0.05% from 150 to 1000

± 0.1% from 50 to 100
± 0.05% from 150 to 1000

± 0.1%

Infinite

Infinite

Infinite

Infinite

-30..+100°C

-30..+100°C

-30..+100°C

-30..+100°C

5 m/sec

5 m/sec

5 m/sec

1.5 m/sec

IP67

IP68

IP67

IP67

Ring cursor

Ring cursor

Rod

Ring cursor

Brackets
(variable distances
between centers)

Flange

Self-aligning joints

Flange

For pneumatic cylinders. Pre-wired models or models with connector. High protection level and sturdiness guarantee long life.

For hydraulic and oil pressure cylinders. Model with threaded flange lets you install transducer without removing cylinder.

Coaxial rod for installation with self-aligning joints. Low friction, self-cleaning rod completely in anodized aluminum.

The best solution for installation in small spaces. Used especially inside pneumatic cylinders.

INJECTION PRESSES
PNEUM. CYLINDERS
GEOTECHNICS
SANDERS
GLASS MACHINES

GEOTECHNICS
UTILITY VEHICLES
HYDRAULIC CYLINDERS
BOTTLING

INJECTION PRESSES
EARTH MOVING
ELEVATORS
SANDERS
LEATHERWORKING

PNEUMATIC CYLINDERS

SHORT STROKES

Magnetostriuctive displacement transducers

MODEL

LT67

PC67

PZ67A

PZ67S

USEFUL ELECTRICAL STROKE RANGE

50..900 mm

50..750 mm

25..300 mm

25..300 mm

INDEPENDENT LINEARITY

± 0,05%
± 0,075% for strokes
≤150mm

± 0,05%
± 0,075% for strokes
≤150mm

± 0,2% for 25
± 0,1% from 50 to 100
± 0,05% from 125 to 300

± 0,2% for 25
± 0,1% from 50 to 100
± 0,05% from 125 to 300

RESOLUTION

Infinite

Infinite

Infinite

Infinite

WORK TEMPERATURE RANGE

-30..+100°C

-30..+100°C

-30..+100°C

-30..+100°C

DISPLACEMENT SPEED

Standard: 3 msec
(max: 5 msec)

Standard: 3 msec
(max: 5 msec)

Standard: 3 msec
(max: 5 msec)

Standard: 3 msec
(max: 5 msec)

PROTECTION LEVEL

IP67

IP67

IP67

IP67

TIPO ATTUATORE

Rod

Rod

Rod

Rod

MOUNTING

Brackets
M5 screw ISO4017
DIN933

Selfloading and
selfaligning
ball-joints

Self-aligning joints with
adjustable distance
between centers

Brackets
(variable distances
between centers)

APPLICATIONS

is designed to guarantee a high protection level (IP67) in applications under harsh conditions and outdoors, where it may be necessary to work in the direct presence of dust, dirt, or liquids (not in prolonged immersion).

INJECTION PRESSES

MOBILE HYDRAULICS
AGRICULTURAL MACHINES
EARTH MOVING

TEST BENCH
EQUIPMENT

GLASS WORKS
WOOD WORKS

**MODEL**

PS09

PS11

PS20

PR65

USEFUL ELECTRICAL STROKE RANGE

340° ± 4°

345° ± 4°

350° ± 4°

345° ± 4°

INDEPENDENT LINEARITY± 1 .. ± 0.05%
(on request)± 1 .. ± 0.05%
(on request)± 1 .. ± 0.05%
(on request)± 1 .. ± 0.05%
(on request)**RESOLUTION**

Infinite

Infinite

Infinite

Infinite

WORK TEMPERATURE RANGE

-55...+100°C

-55...+100°C

-55...+100°C

-55...+100°C

MAXIMUM ROTATION SPEED

600 U/min

600 U/min

600 U/min

600 U/min

MAXIMUM TORQUE

0,20 Ncm

0,20 Ncm

0,20 Ncm

1,8 Ncm

PROTECTION LEVEL

IP40

IP40

IP40

IP65

INSTALLATIONServo
(flange)Servo
(flange)Servo
(flange)Servo
(flange)**OUTSIDE DIAMETER**

22,25 mm

27,05 mm

50,80 mm

55 mm

SHAFT DIAMETER

3,175 mm

3,175 mm

6,35 mm

6 mm

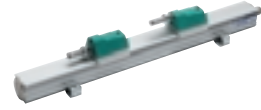
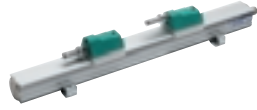
APPLICATIONS

For measurement, control, and instrumentation applications. A high-precision angular displacement transducer that satisfies the requirements of most analog applications. Stainless steel shaft, gold-welded terminals; all metal parts protected against corrosion.

High protection level, all-metal housing.

PROFILE

Improved internal structure with security set screws



MODEL

MK4-A

MK4-D

USEFUL ELECTRICAL STROKE RANGE

50..4000 mm

50..4000 mm

INDEPENDENT LINEARITY

± 0,02%

± 0,02%

RESOLUTION

Infinite

max10 µm

WORK TEMPERATURE RANGE

-30..+75°C

-30..+75°C

MAXIMUM DISPLACEMENT SPEED

10 m/sec

10 m/sec

INTERFACE

Analog

Digital

MEASUREMENT TAKEN

1 cursor (single output)
1 cursor (normal+reverse)
1 cursor (displacement+speed)
2 cursors

1 cursor (PWM)
Multicursor (start/stop)

PROTECTION LEVEL

IP67

IP67

INSTALLATION

Brackets (variable distances between centers)

Brackets (variable distances between centers)

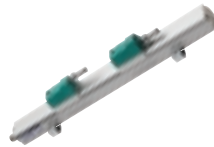
APPLICATIONS

High precision guaranteed by better linearity than with potentiometers. Ideal for harsh environments thanks to high protection level. Analog or digital interface for direct link to PLC. Brackets allow installation in most appropriate position.

- INJECTION PRESSES
- PLASTIC AND GLASS BLOWING
- MARBLE AND CERAMIC WORKING
- METALWORKING

Improved internal structure with security set screws

PROFILE



MK4-S

MK4-C

MK4-P

50..4000 mm

50..4000 mm

50..4000 mm

± 0,02%

± 0,02%

± 0,02%

max 2 μm

max 2 μm

Up to 5 μm

-30..+75°C

-30..+75°C

-30..+75°C

10 m/sec

10 m/sec

10 m/sec

SSI

CANopen

PROFIBUS

1 cursor

from 1 to 4 cursors

from 1 to 4 cursors

IP67

IP67

IP67

Brackets
(variable distances
between centers)

Brackets
(variable distances
between centers)

Brackets
(variable distances
between centers)

SSI digital interface allows
high-precision absolute
displacements.

CANopen interface
allows connection via
fieldbus.

The Profibus fieldbus
communication interface
permits integration in
complex systems with large
communication distances,
guaranteeing safe and rapid
data transmission.

SERVO-DRIVES
ROBOTICS

PRESSES
ROBOTICS
MACHINE TOOLS

INJECTION PRESSES
STEEL WORKS
PLANT AUTOMATION

Magnetostriuctive displacement transducers

...

ROD



| MODEL | IK1-A | IK1-D | IK2-S | IK2-C |
|--------------------------------|--|---|--|----------------|
| USEFUL ELECTRICAL STROKE RANGE | 100..4000 mm | 100..4000 mm | 100..4000 mm | 100..4000 mm |
| INDEPENDENT LINEARITY | ± 0,02% | ± 0,02% | ± 0,02% | ± 0,02% |
| RESOLUTION | max 0,5 µm | max 10 µm | max 2 µm | max 2 µm |
| WORK TEMPERATURE RANGE | -30..+70°C | -30..+70°C | -30..+70°C | -30..+70°C |
| MAXIMUM DISPLACEMENT SPEED | 10 m/sec | 10 m/sec | 10 m/sec | 10 m/sec |
| INTERFACE | Analog | Digital | SSI | CANopen |
| MEASUREMENT TAKEN | 1 cursor (normal+reverse) | 1 cursor (PWM) 1 cursor (start/stop) | 1 cursor | 1 or 2 cursors |
| PROTECTION LEVEL | IP67 | IP67 | IP67 | IP67 |
| INSTALLATION | Flange | Flange | Flange | Flange |
| APPLICATIONS | Specifically designed for insertion in hydraulic and pneumatic cylinders thanks to small size of rod and magnet. Analog or digital interface for direct link to PLC or other standard electronics. Standard flange for quick and simple installation. EARTH MOVING NAUTICAL SECTOR LEVEL CHECKS | | Precision of digital signal plus practical SSI or CANopen interface allows adaptation in existing plants using standard communication systems. FOOD LEVEL CHECKS SERVO-ASSISTED CYLINDERS | |



IK2-P



IK4-A



IK4-C

50..4000 mm

50..4000 mm

50..4000 mm

± 0,02%

± 0,02%

± 0,02%

max 5 µm

infinite

max 2 µm

-30..+75°C

-30..+75°C

-30..+75°C

10 m/sec

10 m/sec

10 m/sec

PROFIBUS

Analog

CANopen

From 1 to 4 cursors

1 cursor (normal+reverse)

From 1 to 4 cursors
(displacement+speed)

IP67

IP67

IP67

Flange

Flange

Flange

The Profibus fieldbus communication interface permits integration in complex systems with large communication distances, guaranteeing safe and rapid data transmission.

The IK4 line's new mechanical structure offers improved features for in-cylinder use, including a series of new multi-connector models, free rotation of the connector head, and replacement of internal electronics without removal of the transducer.

HYDRAULIC SYSTEMS FOR PLANT AUTOMATION

HYDRAULIC SYSTEMS FOR PLANT AUTOMATION
INDUSTRIAL HYDRAULICS
LEVEL CHECKS

ROD

Magnetostriuctive displacement transducers



| MODEL | RK- | RK-A | RK-C |
|--------------------------------|---|---|---|
| USEFUL ELECTRICAL STROKE RANGE | 50..4000 mm | 50..4000 mm | 50..4000 mm |
| INDEPENDENT LINEARITY | ± 0,02% | ± 0,02% | ± 0,02% |
| RESOLUTION | infinite | 16 bit | 16 bit |
| WORK TEMPERATURE RANGE | -30..+90°C | -30..+90°C | -30..+90°C |
| MAXIMUM DISPLACEMENT SPEED | 10 m/sec | 10 m/sec | 10 m/sec |
| INTERFACE | Analog Digital RS422 Start/Stop | Analog | CANopen |
| MEASUREMENT TAKEN | 1 Cursor | 1 cursor (normal+reverse) 1 Cursor (displacement+speed) 2 Cursors | 1 Cursor (displacement+speed) |
| PROTECTION LEVEL | IP67 | IP67 | IP67 |
| INSTALLATION | Internal flange Threaded external flange | Internal flange Threaded external flange | Internal flange Threaded external flange |
| APPLICATIONS | <p>The separate, remote electronics (up to a maximum of 50 meters) reduces sensor size to a minimum and facilitates installation in the cylinder. The overall dimensions of the sensor are among the smallest available on the market.</p> <p>EARTH MOVING AGRICULTURAL MACHINES UTILITY VEHICLES INDUSTRIAL HYDRAULICS</p> | | |

ACCESSORIES

SIGNAL CONDITIONERS FOR POTENTIOMETRIC TRANSDUCERS

PCIR-101: Output 0...10Vdc
PCIR-102: Output 4...20mA



Interface module integrated in female connector
(directly connectable to series LT and PK)
Standard output 0...10Vcc (PCIR 101)
Standard output 4...20mA (PCIR 102)
High linearity (0.01% FSO)
Lower Zero and Span thermal drift
Settable Zero and Span

PCIR-A: Output 0...10Vdc



High input impedance (>100 MOhm)
Standard output 0...10Vcc
Linearity error: 0.02% FSO
Thermal drift: 0.01% FSO/°C
Simultaneous control of two transducers
Preset for DIN EN50035 and EN50022 mounting
MORO31 female connector

JOINTS FOR POTENTIOMETRIC TRANSDUCERS

PKIT015: for series LT



SND009: for series LT



CURSORS FOR MAGNETOSTRICTIVE TRANSDUCERS

SERIE MK4

PCUR034



PCUR035



PCUR036



PCUR037



SERIE IK

PCUR026



PCUR027



PCUR022



PCUR023



PCUR024



Ø int. 12,5 mm
Ø est. 54 mm
length 70 mm

Ø int. 15 mm
Ø est. 54 mm
length 70 mm

Ø int. 13,5 mm
Ø est. 32,8 mm
thickness 7,9 mm

Ø int. 13,5 mm
Ø est. 32,8 mm
thickness 7,9 mm

Ø int. 13,5 mm
Ø est. 32,8 mm
thickness 7,9 mm

ACCESSORIES

FEMALE CONNECTOR FOR POTENTIOMETRIC TRANSDUCERS

3-pin connectors
CON002



4-pin connector (DIN43650 solenoid valve)
CON006



CON008



5-pin connector (DIN 43322)

CON011



CON012



CON013



M8 pre-wired 3-pin connectors (for PME)
CAV010



6-pin connectors (for IC)
CON300



| MODEL | | | LT | PC | PK | PA1 | PY1 | PY2 | PY3 | PME | IC |
|----------|------|--------|------|------|------|-------|-------|-------|-------|-------|------|
| 3 PIN | IP40 | CON002 | LT-H | PC-H | | | | | | | |
| 4 PIN | IP65 | CON006 | LT-M | PC-M | | | | | | | |
| | IP65 | CON008 | | | | | | | | | |
| 5 PIN | IP40 | CON011 | LT-B | PC-B | PK-B | PA1-C | PY1-C | PY2-C | PY3-C | | |
| | IP67 | CON012 | LT-B | PC-B | PK-B | PA1-C | PY1-C | PY2-C | PY3-C | | |
| | IP40 | CON013 | LT-B | PC-B | PK-B | PA1-C | PY1-C | PY2-C | PY3-C | | |
| 3 PIN M8 | IP67 | CAV010 | | | | | | | | PME-C | |
| 6 PIN | IP67 | CON300 | | | | | | | | | IC-C |

FEMALE CONNECTORS FOR MAGNETOSTRICTIVE TRANSDUCERS

M16 CONNECTORS

CON021 - CON026



CON022 - CON027



CON023 - CON028

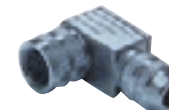


M12 CONNECTORS

CON031



CON041-CON042



| MODEL | CON021 | CON022 | CON023 | CON026 | CON027 | CON028 | CON031 | CON041 | CON035 | CON042 |
|-------|----------------------|----------------------|--------------------------|----------------------|----------------------|--------------------------|----------------------|--------------------------|----------------------|--------------------------|
| | M16 6 pin IP40 | M16 6 pin IP67 | M16 6 pin 90° IP67 | M16 8 pin IP40 | M16 8 pin IP67 | M16 8 pin 90° IP67 | M12 5 pin IP67 | M12 5 pin 90° IP67 | M12 8 pin IP67 | M12 8 pin 90° IP67 |
| | MK4-B | MK4-B | MK4-B | MK4-C | MK4-C | MK4-C | MK4-A | MK4-A | MK4-H | MK4-H |
| | MK2-CB | MK2-CB | MK2-CB | | | | MK2-CM | MK2-CM | | |
| | IK1-B | IK1-B | IK1-B | IK1-C | IK1-C | IK1-C | | | | |
| | IK2-B | IK2-B | IK2-B | | | IK1-C | IK2-CM | IK2-CM | | IC-C |

| | | | |
|---|---|--|---|
| <p>PLASTIC AND RUBBER INJECTION PRESSES: measures displacement of 4 main movements: load, injection, die opening/closing, extraction</p> |  | <p>BLOWING MACHINES: measures displacement of die opening/closing, die translation, Parison check</p> |  |
| <p>MATERIALS WORKING: measures displacement of tools such as brushes, wheels or rolls used in working metal, wood, marble, ceramics</p> |  | <p>HYDRAULIC AND PNEUMATIC CYLINDERS: piston displacement check - the transducer is internal and a magnetic ring cursor is attached to the piston to track its movement</p> |  |
| <p>GEOTECHNICS: use of transducers for subsidence meters and strain gauges for structural monitoring - cylindrical models are preferred</p> |  | <p>AUTOMATIVE TEST MACHINES: tuning of suspensions on prototypes and competition models. Test benches. Racing cars. Crash tests.</p> |  |
| <p>FARM AND EARTH MOVEMENT MACHINES: check position of mechanical arms, bucket angle, plough height off ground, crushers, sizing of asphaltting machines</p> |  | <p>FOOD INDUSTRY: check quantity of substance distributed by filling syringes or other injector machines</p> |  |
| <p>NAUTICAL FIELD: control of the opening and closing of bulkheads; control position and inclination of the paddle (flap) of motors inboard</p> |  | <p>LEVEL CHECKS: measure level of liquids in tanks via selection of float</p> |  |

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