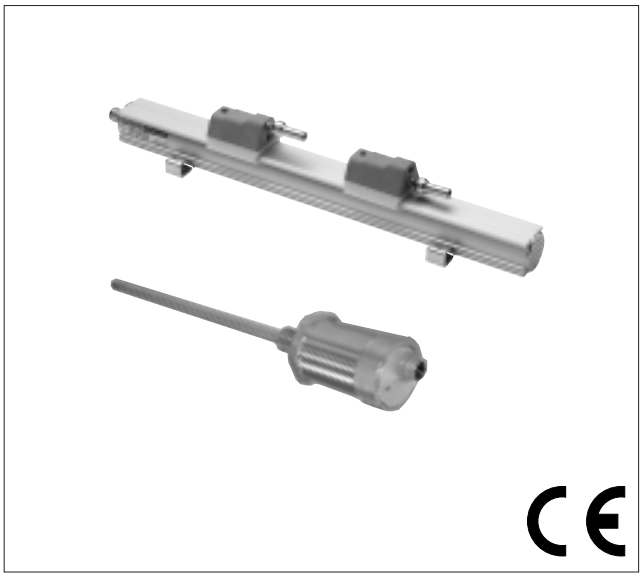
GEFRAN

MK4 and IK4 Series
Installation Manual



Code 85190 **Edition** 12/09

CONTENTS

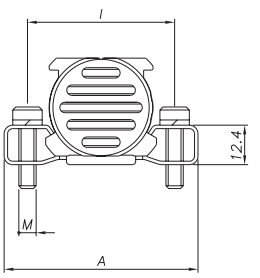
GENERAL PRECAUTIONS

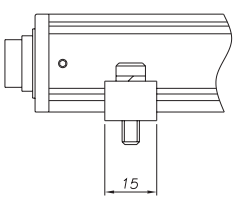
- The transducer must be installed away from sources of magnetic fields, both static and 50 Hz (electric motors, solenoids, etc.).
- The transducer connection cable must be wired separately from power cables and/or solenoid controls, drives, or remote switches.
- The line used for power supply must be dedicated to the transducers or must be drawn directly from the power terminals and as near as possible.
- When choosing a cursor for the MK4 profile magnetostrictive transducer, remember that the transducer's cursor is a magnet. Therefore, if there are iron filings or small magnetic metal fragments in proximity of the transducer, avoid the use of sliding cursors, as there would be a risk of material accumulation on the cursor, creating problems for sliding. Use a floating cursor instead.

MK4 SERIES – CORRECT USE OF INSTALLATION BRACKETS

P K I T ☐ ☐ ☐

Brackets (2 brackets for every kit)	
Steel bracket, interaxis 42.5mm	**090**
Steel bracket, interaxis 50mm	**091**
Stainless steel bracket, interaxis 42.5mm	**093**
Stainless steel bracket, interaxis 50mm	**092**





Brackets code	Interaxis (i)	Screw (V)	Dimension (A)
PKIT090/093	42.5	**M4**	**56**
PKIT091/092	50	**M5**	**63.5**

Use PKIT09x brackets (to be ordered separately) to correctly install the MK4 magnetostrictive transducer.
Choose the best model based on the material, on the attachment holes interaxis and on the dimension of the screws included in the package. Each package has two brackets. We recommend to install one bracket every 250-300 mm.
Always use the isolating bushes supplied in the package to ensure the correct transducer isolation.
To prevent damages to the isolating bushes and to the brackets, tighten the fastening screws with a maximum torque of 1.1 Nm.

MK4 SERIES – CORRECT USE OF THE PCUR034 FLOATING CURSOR

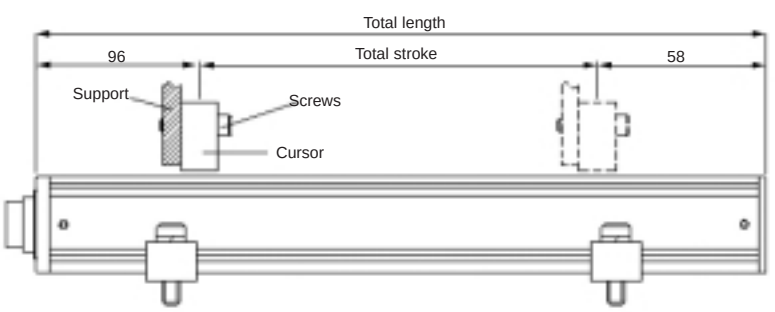


Fig. 1

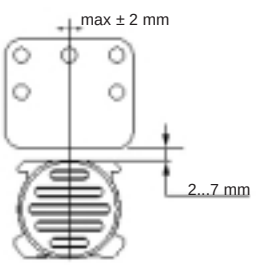


Fig. 2

Under standard conditions (Fig. 1), the PCUR034 cursor must be installed on a support made of non-magnetic material (such as brass, aluminium, or AISI316 stainless steel). The installation kit, consisting of two screws, two nuts, and two washers (all made of brass), is included in the package.
The cursor (Fig. 2) must be installed with maximum attention to horizontal alignment with the transducer axis (maximum tolerance is ± 2 mm), as well as to the distance from the transducer surface from 2 to 7 mm (0 to 7 mm for MK4-S version with digital SSI interface).

If there is no alternative to a magnetic support, it's necessary to prevent the support from changing the magnetic field generated by the cursor, because this could cause problems with the correct measurement of the cursor position.
For this reason, a non-magnetic spacer must be added between the cursor and the magnetic support (Fig. 3 - Sol. 1).
The recommended spacer thickness is 15 mm.

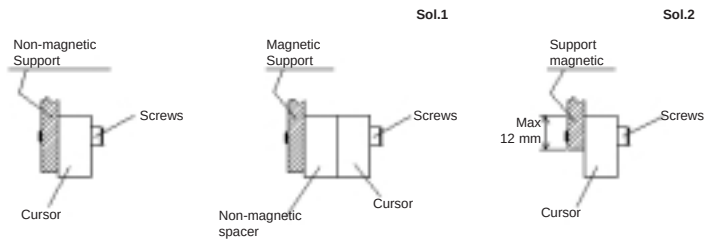


Fig. 3

If the application does not permit the installation of a non-magnetic spacer, it's possible to install the cursor directly on the magnetic support, being careful not to let the support make direct contact with the part of the cursor containing the magnet (Fig. 3 - Sol. 2).
If the application requires installation of multiple cursors (two or more), the cursors must be minimum 75 mm apart (Fig. 4).
Remember that in order to ensure precise measurement, each magnet must be installed at the same distance from the transducer surface.
In addition, all cursors must be kept at the same working temperature.

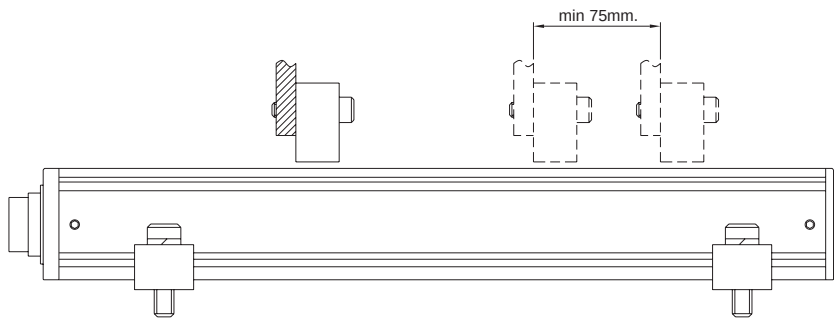


Fig. 4

SERIE IK4 - MOUNTING INSIDE A CYLINDER

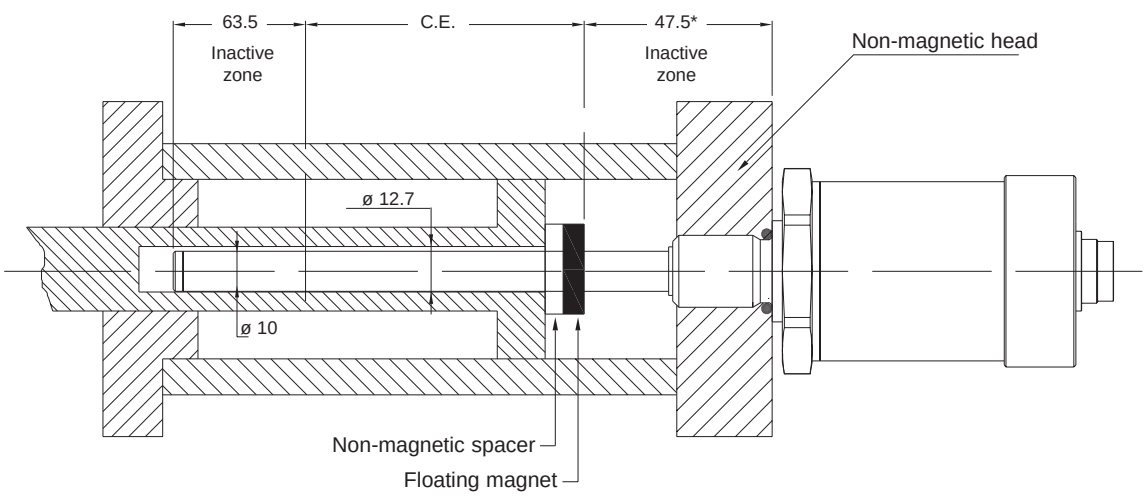


Fig. 5

For the correct installation of rod-type magnetostrictive transducers in hydraulic cylinders, remember that the cylinder head, must be made of non-magnetic material where the threaded hole will be drilled to install the transducer.
If not, the residual magnetisation caused by drilling the threaded hole must be less than 4 Gauss.
Rod-type magnetostrictive transducers are available with two types of threads: M18x1.5 or 3/4"-16 UNF.
Refer to the drawings in figures 5 and 6 for the dimensions and tolerances to be respected when drilling the threaded holes and the related sealing surfaces.
The sealing surface must be free of spiral or longitudinal scratches.

- Ro 1,6 µm for O-rings with NON-pulsing pressure
- Ro 0,8 µm for O-rings with pulsing pressure

Rod-type magnetostrictive transducers are always supplied with an O-ring. If you need to replace the supplied O-ring , see the O-rings shown in figures 6 and 7.

Version with thread M18x1,5

Suggested O-Ring:

PARKER	6-349 15,4x2,1
Material	Viton 90° Shore-A
Mixes	PARKER N552-90

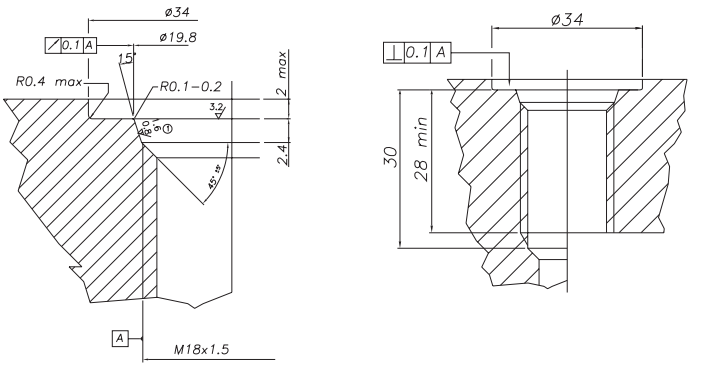


Fig. 6

Version with thread 3/4”-16UNF

Suggested O-Ring:

PARKER	3-908 16,36x2,21
Material	Viton 90° Shore-A
Mixes	PARKER N552-90

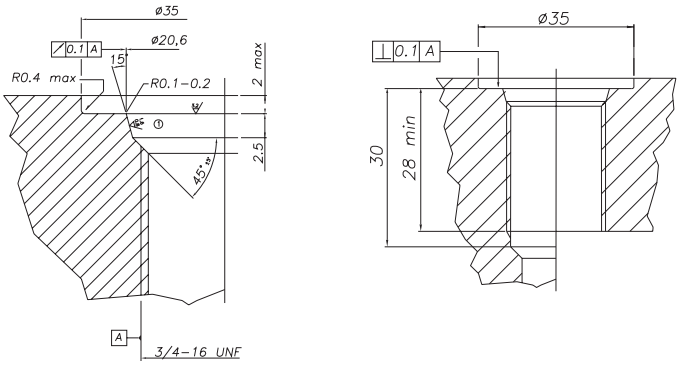


Fig. 7

To prevent alterations of the magnetic field generated by the cursor and, therefore, incorrect measurements by the transducer, the cursor must be installed by placing a non-magnetic spacer (made of brass, aluminium, stainless steel or plastic) between the piston surface and the cursor.
Always use fastening accessories (screws, washers, etc.) supplied with the cursor. When necessary, always use non-magnetic accessories.
Remember to position the cursor in such a way as to allow the correct measurement within the electrical stroke of the magnetostrictive transducer, preventing the cylinder stroke from bringing the cursor into inactive zones of the transducer.

INSTRUCTIONS FOR ELECTRICAL INSTALLATION OF MAGNETOSTRICTIVE TRANSDUCERS

The magnetostrictive transducers conform to the following directives:
- Electromagnetic Compatibility EMC 2004/108/CE
- RoHS 2002/95/CE

For a correct electrical installation of the transducers, refer to the “Manual for Electrical Installation of Magnetostrictives.”
The manual and certificates of conformity can be downloaded from the website www.gefran.com.

DETAILS ON MODELS WITH SSI OUTPUT (MK4-S AND IK4-S)

The diagram shows the operation of a sensor with SSI Synchronous Serial Interface.
The position of the magnet on the sensor is defined by the signal provided by the sensor using the magnetostrictive technology. The displacement signal is supplied in binary or in Gray Code (24-25 bit) and transmitted to the controller by mean of the SSI interface.
The refresh rate can be up to 1000 measurements/second (depending on the transducer’s stroke).
The output is absolute, meaning that the data related to the magnet position are immediately available when the system is turned on again.

BLOCK DIAGRAM

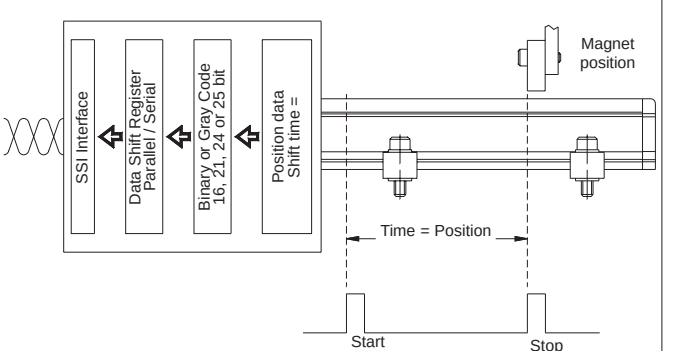
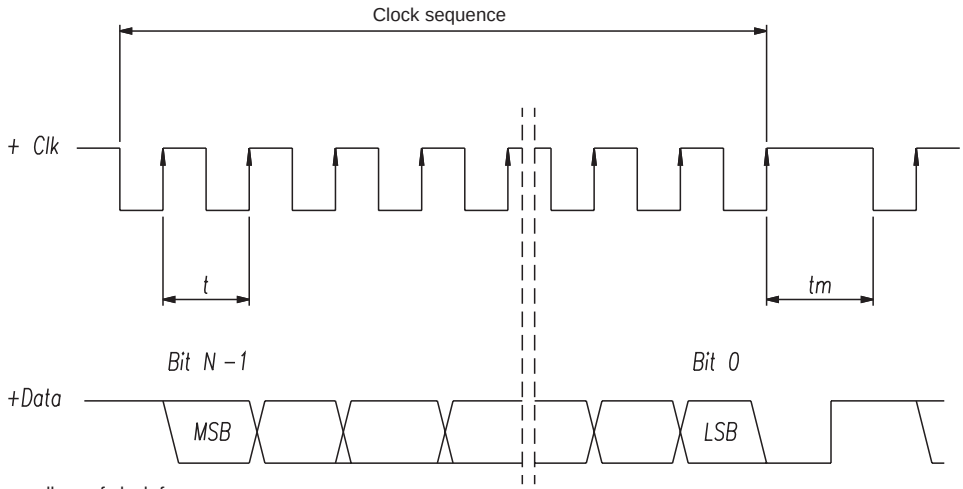


Fig. 8

DATA FORMAT



tm $_{min}$ = 16 µSec, regardless of clock frequency

Fig. 9

BAUD RATE FOR DATA TRANSMISSION
(based on cable length)

Cable length	< 3 m	< 50 m	< 100 m	< 200 m	< 400 m
Baud Rate	1 Mbaud	400 kbaud	300 kbaud	200 kbaud	100 kbaud

Max frequency: 1 MHz
Min frequency: 50 kHz

ERROR MESSAGES

The SSI output goes to 0 if the echo is absent (magnet out of measurement range or internal device error).

OVERSAMPLING OPTION

The position of the magnet on the sensor is defined by the magnetostrictive technology. Internal position sampling can vary from 2 kHz to 500 Hz depending on the stroke. The displacement signal is supplied in binary or Gray code and transmitted to the controller via SSI.
Normally, when data are available, they are transmitted to the SSI shift register, where they are available to the controller.
Therefore, the shift register refresh rate is equal to the internal interrogation rate.
In the version with “oversampling,” the transducer control electronics is synchronised with the SSI clock trains and provides an output before each interrogation. The supplied data are calculated via a first-order interpolation and are equal to:

Out = M + V * T

M = last internal measurement

V = magnet speed

T = time elapsed since last measurement

The data is supplied to the shift register considering possible Jitter in the controller interrogation time (40 µSec is currently considered). Lower Jitter levels ensure better interpolation results (see Figure 10). To maintain synchronism between SSI clock and shift register refresh, the interrogation rate can vary from a maximum of 5.5 KHz to a minimum of 125 Hz.
Typical value considered = 4KHz.

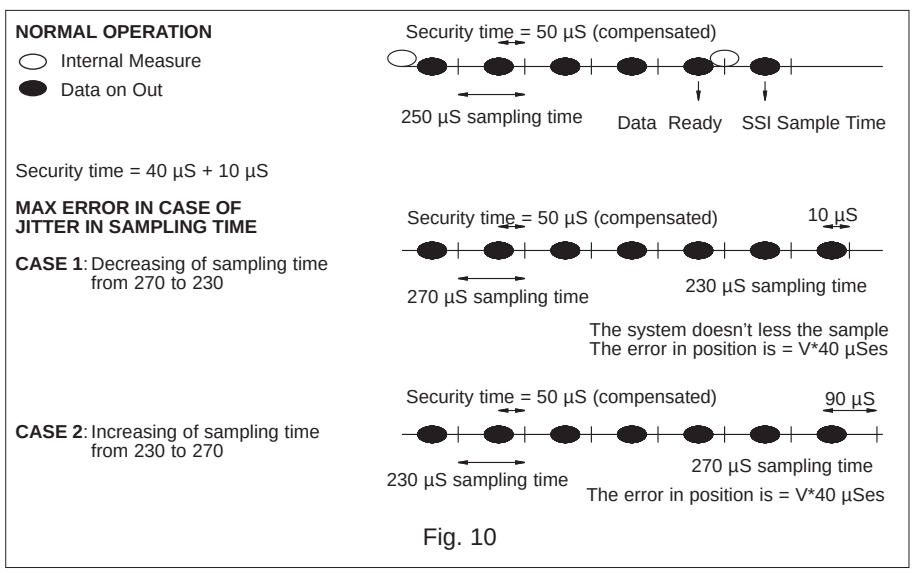


Fig. 10

DETAILS ON MODELS WITH CANOPEN OUTPUT (MK4-C AND IK4-C)

The series of magnetostrictive transducers with CANopen output integrates a microprocessor to process measurement and communication with the CAN field bus by using the CANopen DS-301 protocol and Device Profile DS-406.
By connecting multiple transducers in a CANopen network, it's possible to choose between models with one connector or with two connectors. When using a transducer with single connector, the connection must be in the form of "T" connections, as shown in Fig. 11. In order to avoid the use of "T" connections, it's possible to opt for the 2-connectors model (available with the IK4-C series) to make a connection as shown in Fig. 12.

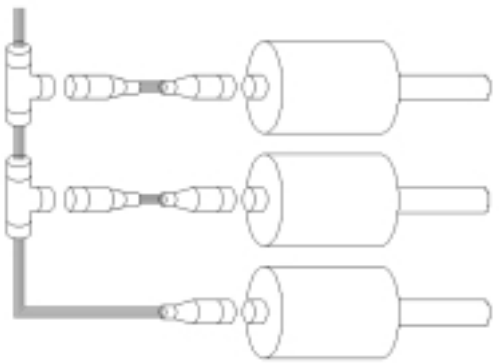


Fig. 11

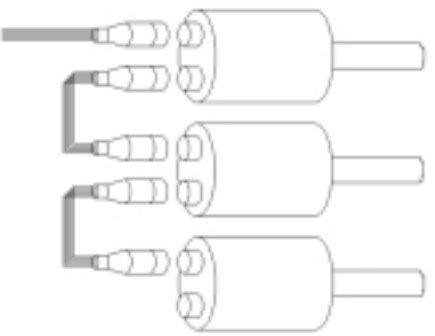


Fig. 12

If the CANopen network terminates with a transducer, that transducer must contain a termination resistor.
The termination resistor integrated in the transducer is an option that can be ordered by specifying it in the order code for the chosen model (see "Order code" on the datasheet).
Each device connected in the CANopen network must have a unique node number that identifies it. Each magnetostrictive transducer is factory programmed with a standard node number of "127".
A few changes to the settings of transducers with CANopen output (such as node number, baud rate, etc.) can be performed by connecting them to a CAN master and programming the parameters in the proper way.
The communication protocol, the list, and the description of the transducer's parameters are shown in the manual, that can be downloaded from the website www.gefran.com.

DETAILS ON MODELS WITH PROFIBUS OUTPUT (MK4-P AND IK2-P)

The series of magnetostrictive transducers with Profibus output integrates a microprocessor to process measurement and communication on RS485 by using the Profibus DPV0 protocol, IEC 61158 standard.
A Profibus network allows to connect peripheral devices defined as Slaves (transducers or actuators) and main control units defined as Class 1 Masters (typically PLCs).
The network software is installed by means of a Class 2 Master containing the database with the GSD files of all connected devices. The network is drawn and parameterized with a graphic tool, then the configuration is downloaded in the Class 1 Masters in the network.
The Class 1 Master(s) launch(es) the communication process with the peripheral devices according to the configuration received from the Class 2 Master.
This process includes an exchange of initial data regarding identification of the Slaves and their parameterization and configuration.
When this phase is completed, the control of the application begins with an exchange of process data on the network.
The GSD file contains all of the data related to the device identification, the supported functions, and the data packets length and format. The GSD file can be downloaded from the website www.gefran.com.
Each transducer is connected to the Profibus network by mean of two M12 connectors (for communication) plus one M8 connector (for power supply).
This means that the transducer can be powered even when it is not connected to the Profibus network, and eliminates the need of "T" connections.
If the Profibus network terminates with a transducer, that transducer must have a termination resistor.
The termination resistor can be ordered as a separate accessory (see "Optional Accessories" on the datasheet).

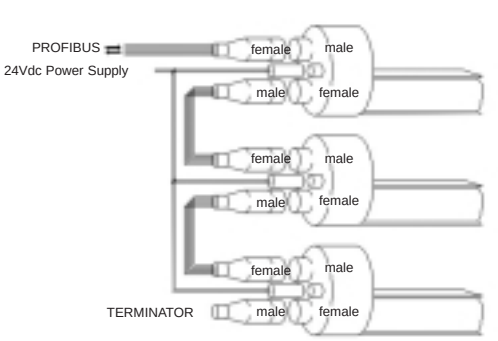


Fig. 13

Each device connected in the Profibus network must have a unique node number that identifies it.
Each magnetostrictive transducer is factory programmed with a standard node number of “125”.
A different address can be arranged at the time of order (see “Order code” on the datasheet).
The address can always be changed later via SAP55 with a SET_SLAVE_ADDRESS telegram by using a Class 2 Master.
The addresses that can be accessed and assigned to the slave range go from 0 to 126.
The network configurator must use a class 2 master in order to independently change the address.
The Class 2 Master is a software tool combined with an appropriate hardware card which are able to send this type of telegram (SAP 55 to the slave).
For details about this procedure, see the “Profibus DP Slave Manual,” which can be downloaded from the website www.gefran.com.
For example, the manual describes the procedure for changing slave address when Siemens hardware and software (Step7) are used.

DIAGNOSTICS OF MODELS WITH LEDS

Some magnetostrictive transducers have LEDs to display some simple diagnostic functions.
Based on the model, the state of the LEDs may have different meanings, as shown in the following table.

IK4-A Series (analogue output)

Red LED	Meaning
on	Transducer powered and working correctly
flashing	Echo absent (magnet out of measurement range or internal device error)
off	Transducer not powered

IK4-S Series (SSI output) and IK4-C Series (CANopen output)

Red LED	Meaning
on	Echo absent (magnet out of measurement range or internal device error)
off	Transducer working correctly

MK4-P and IK2-P Series (Profibus DP output)

Green LED (ON)	Red LED (SF)	Red LED (BF)	Meaning
off	**off**	**off**	Transducer not powered
on	**on**	**on**	Internal error (initialisation error) Master not connected to network
on	**off**	**on**	Initialisation correct Network error, Master not connected to network
on	**on**	**off**	Echo absent (magnet out of measurement range or internal device error)
on	**on/off**	**flashing.1kHz**	Master connected to network Parameterisation or configuration error
on	**off**	**off**	Device in data exchange