



Code 85190M Edition 11-2023

Contents

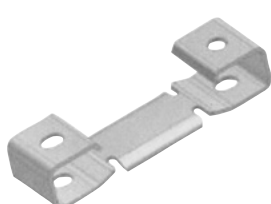
GENERAL PRECAUTIONS	2
MK4/WP SERIES – CORRECT USE OF INSTALLATION BRACKETS	2
MK4/WP SERIES – CORRECT USE OF THE PCUR039/PCUR202/PCUR230 FLOATING CURSOR	3
IK4/WRG/WRP/WRA/RK4 SERIES - MOUNTING INSIDE A CYLINDER	4
RK2 SERIES - MOUNTING INSIDE A CYLINDER	5
IK4/WRG/WRP/WRA/RK2/RK4 - MAGNET INSTALLATION SEAT	5
INSTRUCTIONS FOR ELECTRICAL INSTALLATION OF MAGNETOSTRICTIVE TRANSDUCERS	6
DETAILS ON MODELS WITH SSI OUTPUT (MK4-S/WPP-S/WPA-S E IK4-S/WRP-S/WRA-S)	6
DATA FORMAT	6
ERROR MESSAGES	7
OVERSAMPLING OPTION	7
DETAILS ON MODELS WITH CANOPEN OUTPUT (MK4-C AND IK4-C)	8
DETAILS ON MODELS WITH PROFIBUS OUTPUT (MK4-P/IK4-P)	9
DIAGNOSTICS OF MODELS WITH LEDS	10
DETAILS ON MODELS WITH PROFINET OUTPUT (WPA-F/WRA-F)	11
DIAGNOSTICS OF MODELS WITH LEDS WPA-F / WRA-F SERIES (PROFINET OUTPUT)	12
DETAILS ON MODELS WITH ETHERCAT OUTPUT (WPA-E/WRA-E)	13
DIAGNOSTIC OF MODELS WITH LEDS: WPA-E / WRA-E SERIES (ETHERCAT OUTPUT)	14

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/WP 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/WP SERIES – CORRECT USE OF INSTALLATION BRACKETS

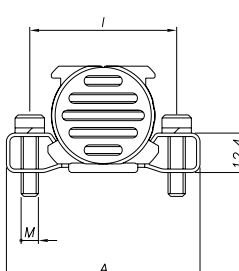


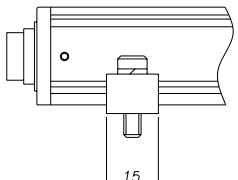
P

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/WP 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. To guarantee the correct electrical insulation of the transducer from the machine, always assemble the brackets using the plastic washers provided in the package as shown in the fig. a and fig. b. To prevent damages to the isolating bushes and to the brackets, tighten the fastening screws with a maximum torque of 1.1 Nm.

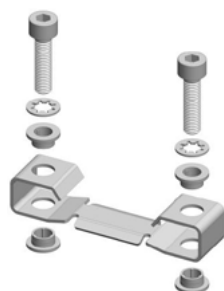


fig. a

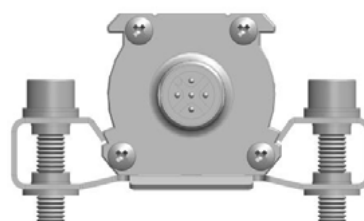


fig. b

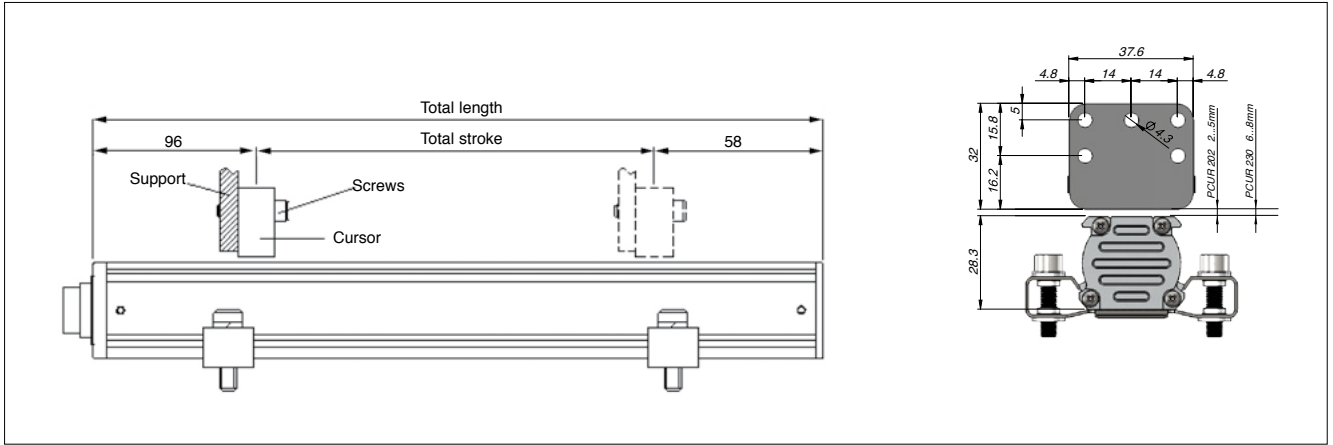


Fig. 1

Fig. 2

Under standard conditions (Fig. 1), the cursor PCUR039/PCUR202/PCUR230 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.

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. 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).

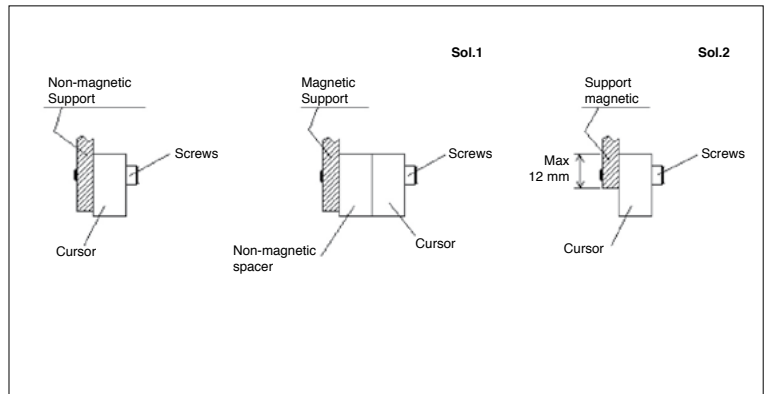


Fig. 3

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.

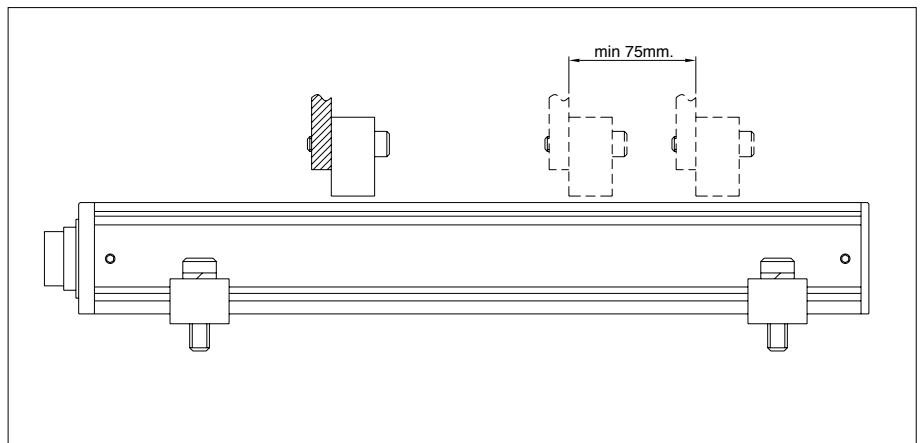


Fig. 4

IK4/WRG/WRP/WRA/RK4 SERIES - MOUNTING INSIDE A CYLINDER

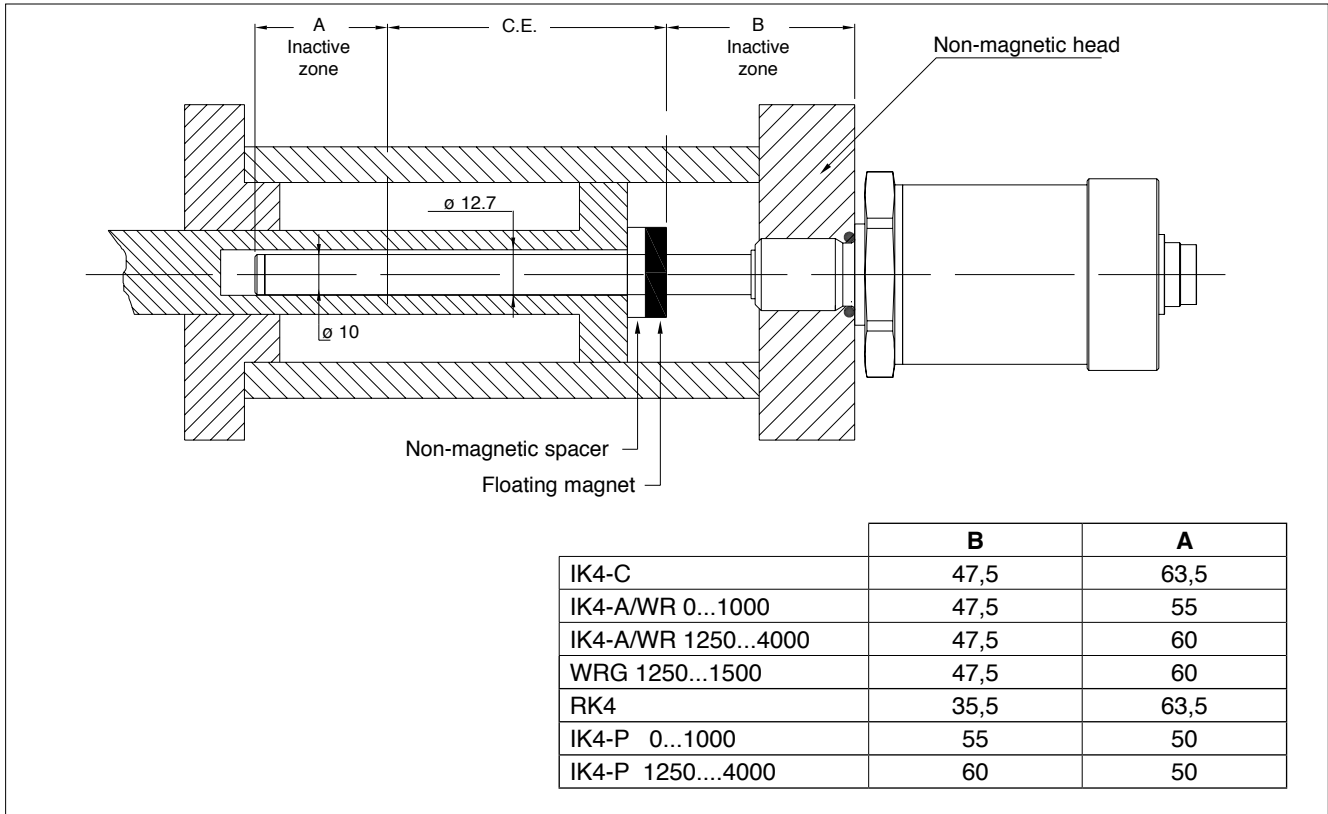


Fig. 5

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.

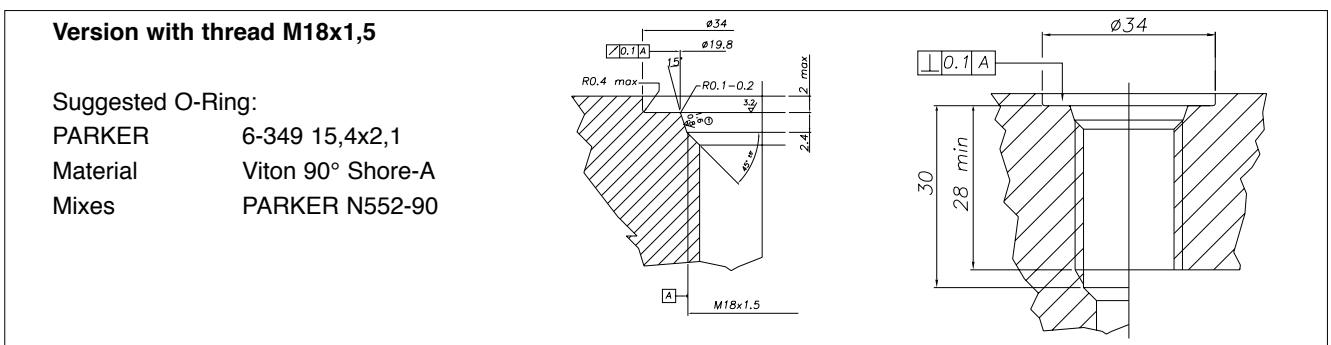


Fig. 6

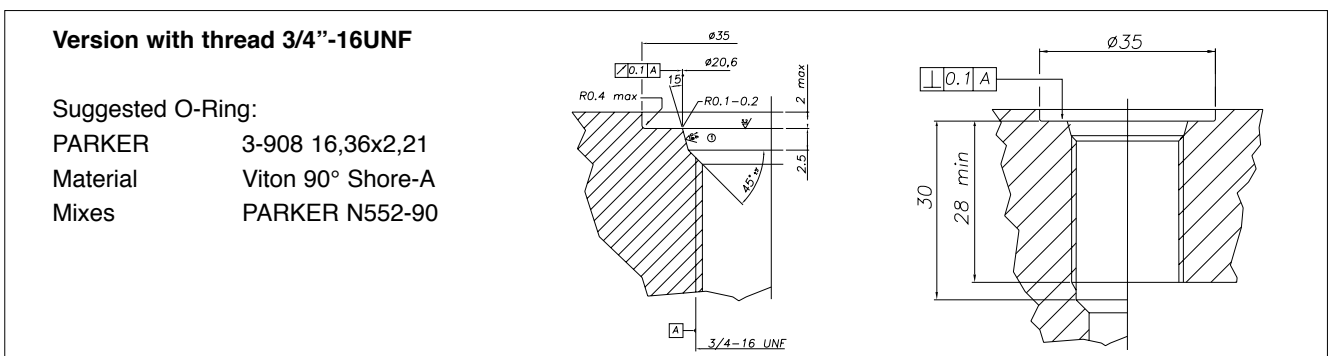


Fig. 7

RK2 SERIES - MOUNTING INSIDE A CYLINDER

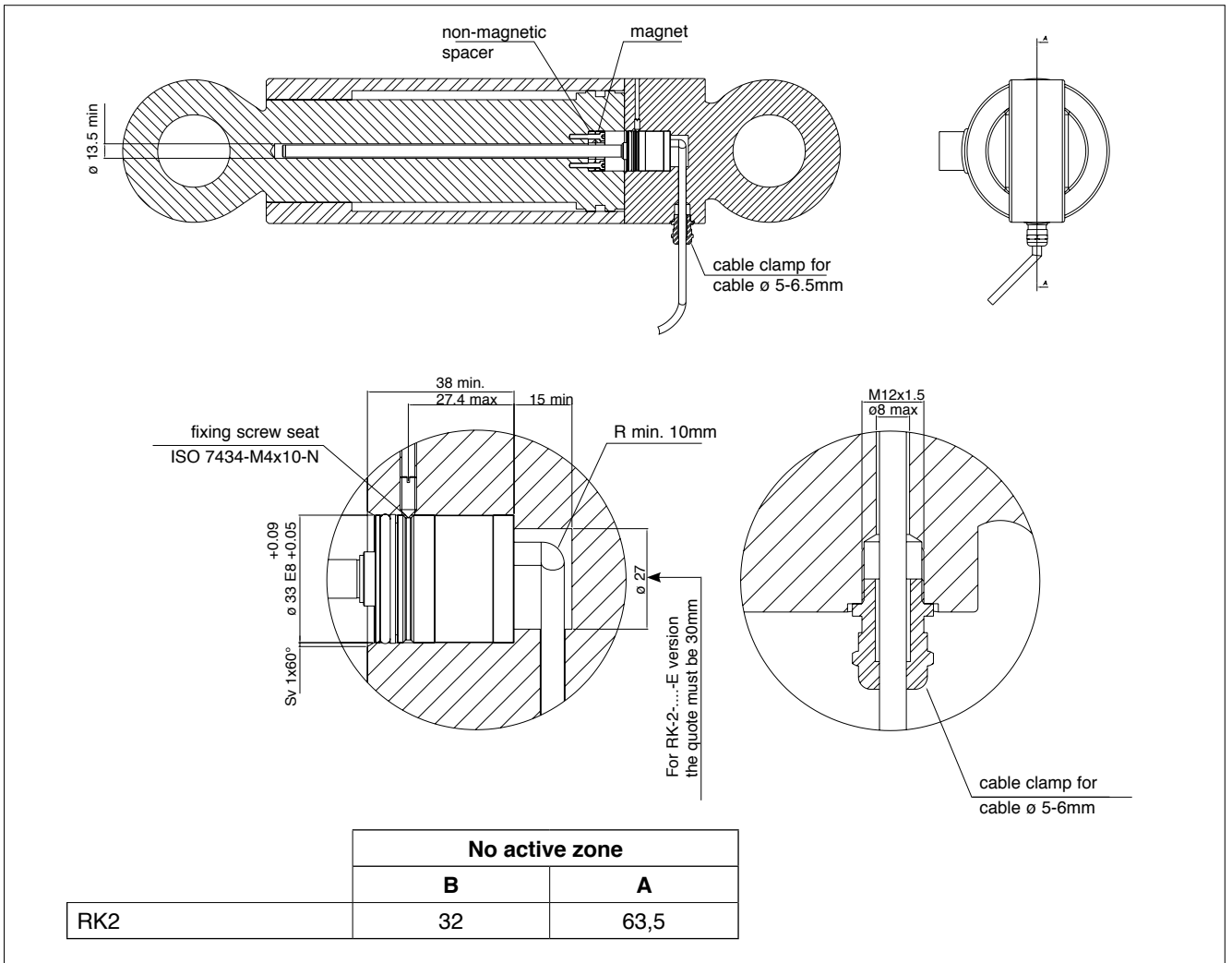
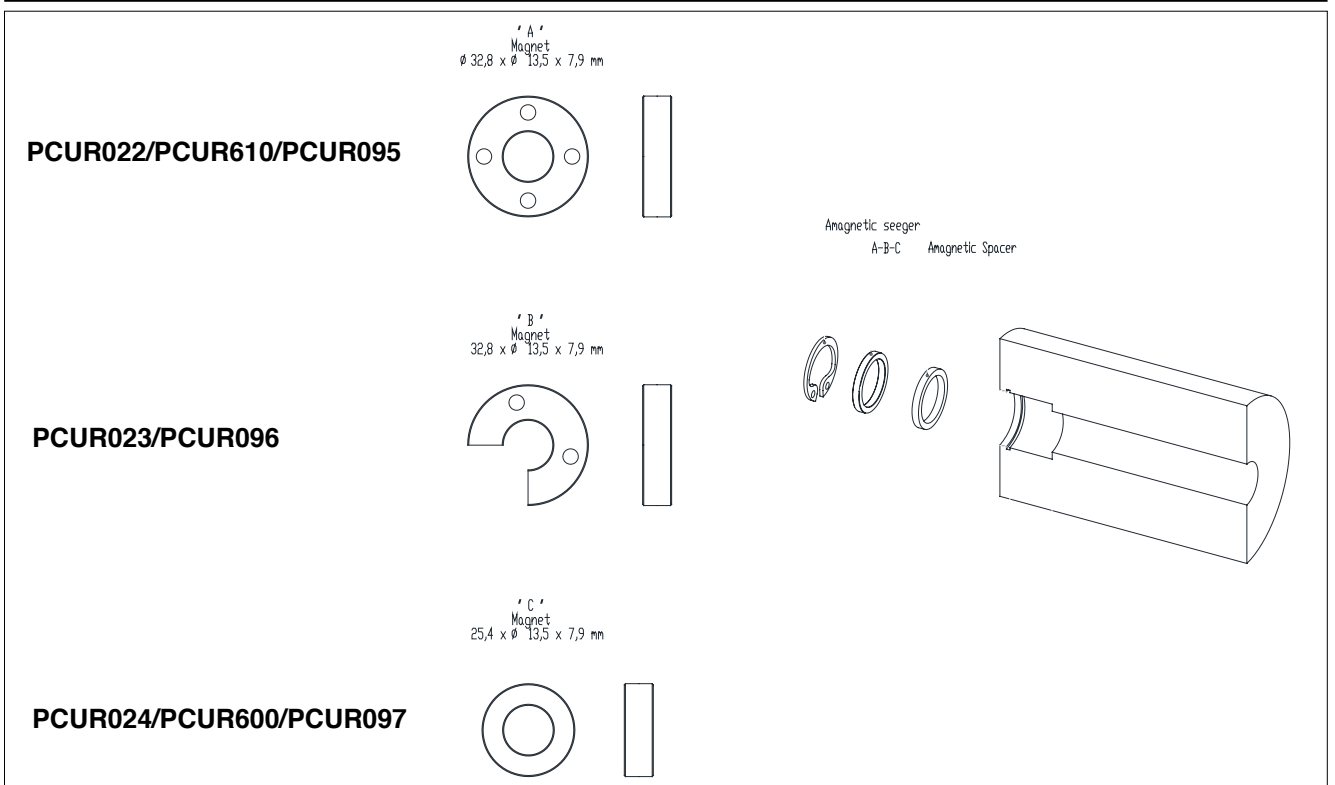


Fig. 5.a

For the correct installation of the rod/flange magnetostrictive transducers RK2 series, please refer to the drawings shown in Figure 5a for what concerns the dimensions and tolerances to be observed in the construction of the seat sensor and its sealing surfaces. The sealing surface must be free from scratches spiral or longitudinal.

IK4/WRG/WRP/WRA/RK2/RK4 - MAGNET INSTALLATION SEAT



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 2014/30/EU
- RoHS 2011/65/EU

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/WPP-S/WPA-S E IK4-S/WRP-S/WRA-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. The SSI interface is

asynchronous; contact Gefran support to evaluate special executions and alternative technical feasibility

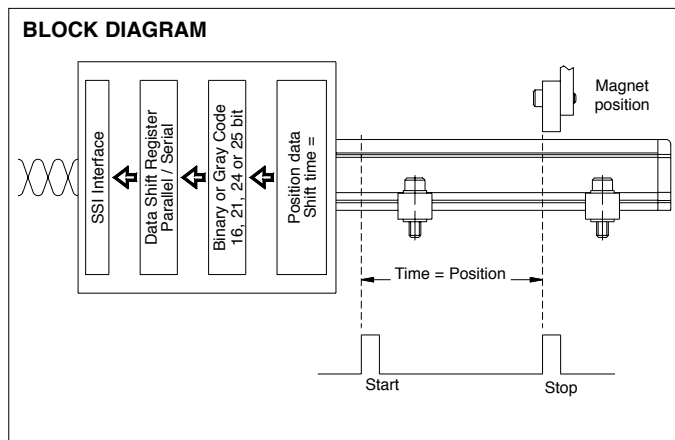
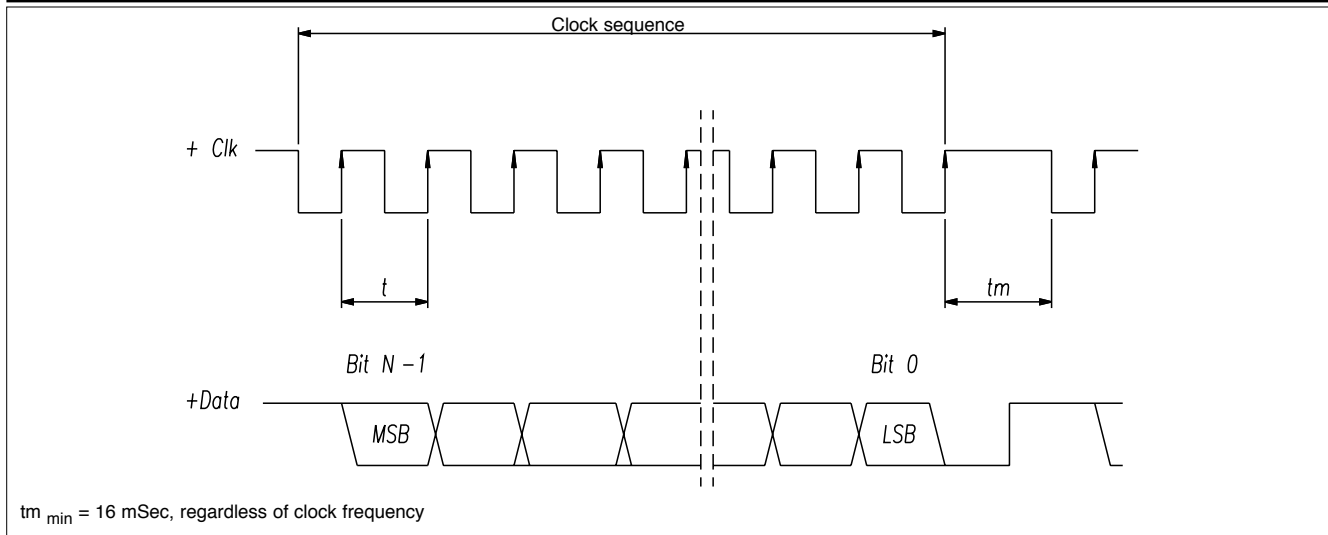


Fig. 8

DATA FORMAT



$t_{m \min} = 16 \text{ mSec}$, 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:

$$\text{Out} = M + V * T$$

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 mSec 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.

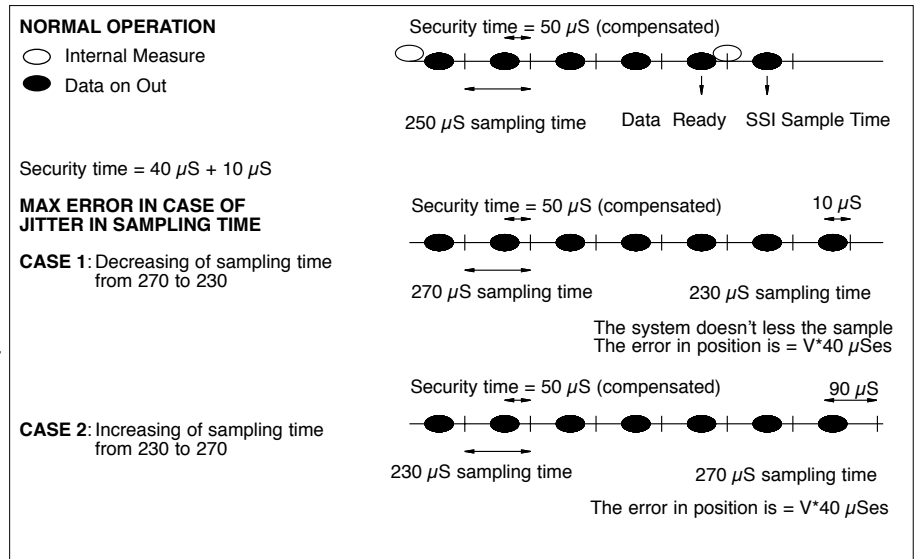


Fig. 10

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.

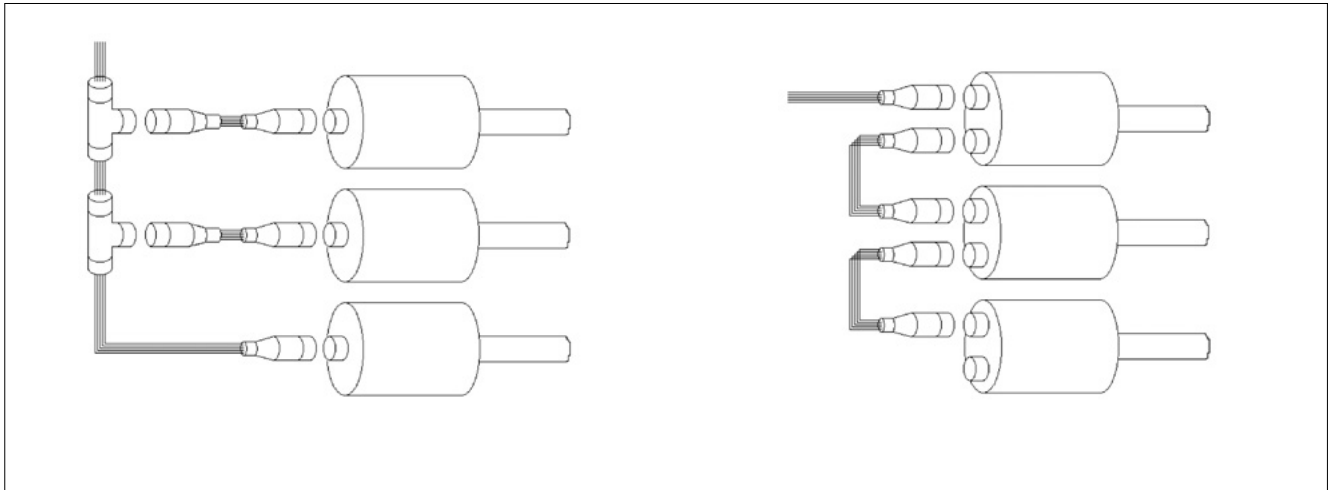


Fig. 11

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/IK4-P)

A Profibus network lets you connect peripheral Slave devices (transducers or actuators) to Class 1 Master central control units (typically PLCs).

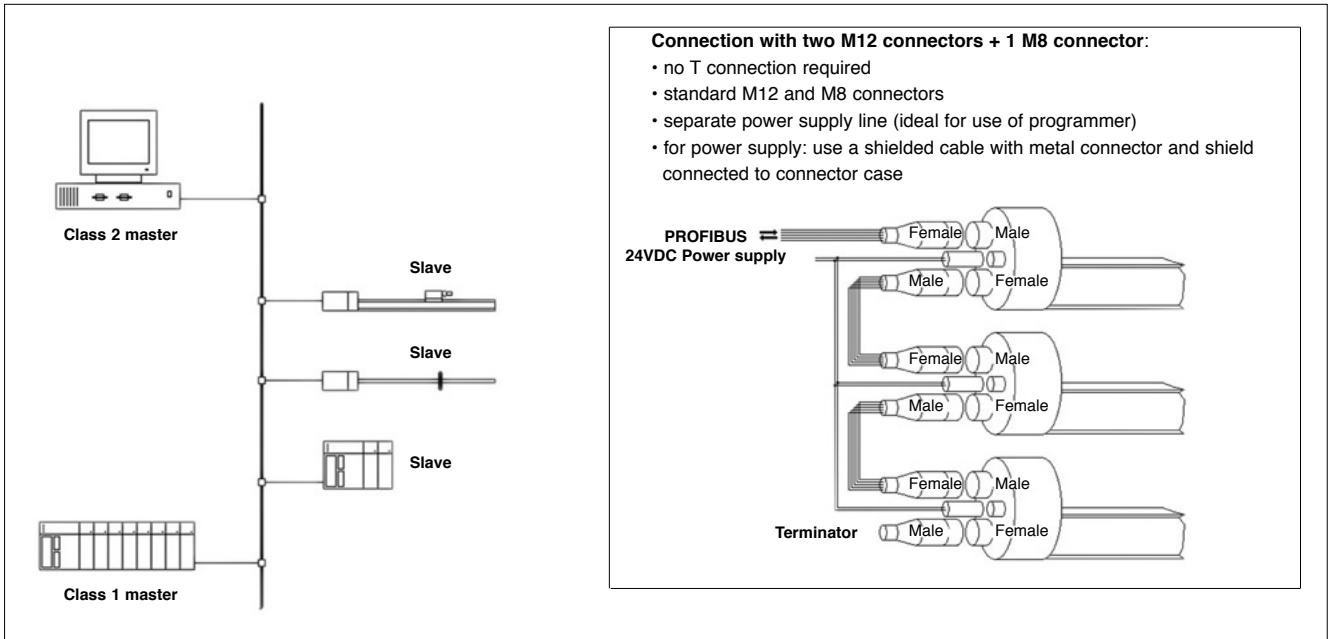
The network software is installed with a Class 2 Master containing a database with the GSD files of all connected devices. The network is designed and parameterized with a graphics tool, then the configuration is downloaded to the Class 1 Masters in the network.

The Class 1 Master(s) start(s) the communication process with the peripheral devices according to the configuration received from the Class 2 Master.

This process includes an initial Data-Exchange regarding Slave identification, parameterization, and configuration.

When this phase is done, application management begins with exchange of process data on the network.

The GSD file contains all information on device identification, supported functions, and length/format of data packets.



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

MK4P / IK4P Series (Profibus output)		
Red LED	Green LED	Meaning
off	off	Transducer not powered
off	flashing (f= 1 HZ)	Transducer ready to initiate communication with the Master (state =Walt Parm)
off	acceso	Transducer in cyclic communication with the master (state= Data_Exch).
on	on	1. ON: signaling correct functioning of the LEDS. ----- 2. In "Data-Exchange" modality, reporting error magnet (the number of magnets detected is not compatible with the current parameter setting).

WRP-A / WRA-A Series (analogue output)	
Blue LED	Meaning
on	Transducer powered and working correctly
flashing	Echo absent (magnet out of measurement range or internal device error)
off	Transducer not powered

WRP-S / WRA-S Series (SSI output)	
Blue LED	Meaning
on	Transducer powered and working correctly
flashing	Echo absent (magnet out of measurement range or internal device error)
off	Transducer not powered

DETAILS ON MODELS WITH PROFINET OUTPUT (WPA-F/WRA-F)

WPA-F / WRA-F magnetostrictive transducer implements Profinet IO communication.

Profinet is a digital communication standard developed and maintained by PI (Profibus and Profinet International).

The digital communication allows the transfer of data between the Device (the WPA-F/WRA-F transducer) and the Master (PLC)

through a network.

These data are:

- Process data, such as position, speed, status of the device
- Acyclic data, as parameterization, statistic, diagnostic data

Profinet standard provides a descriptor file called GSDML (General Station Description based on XML format).

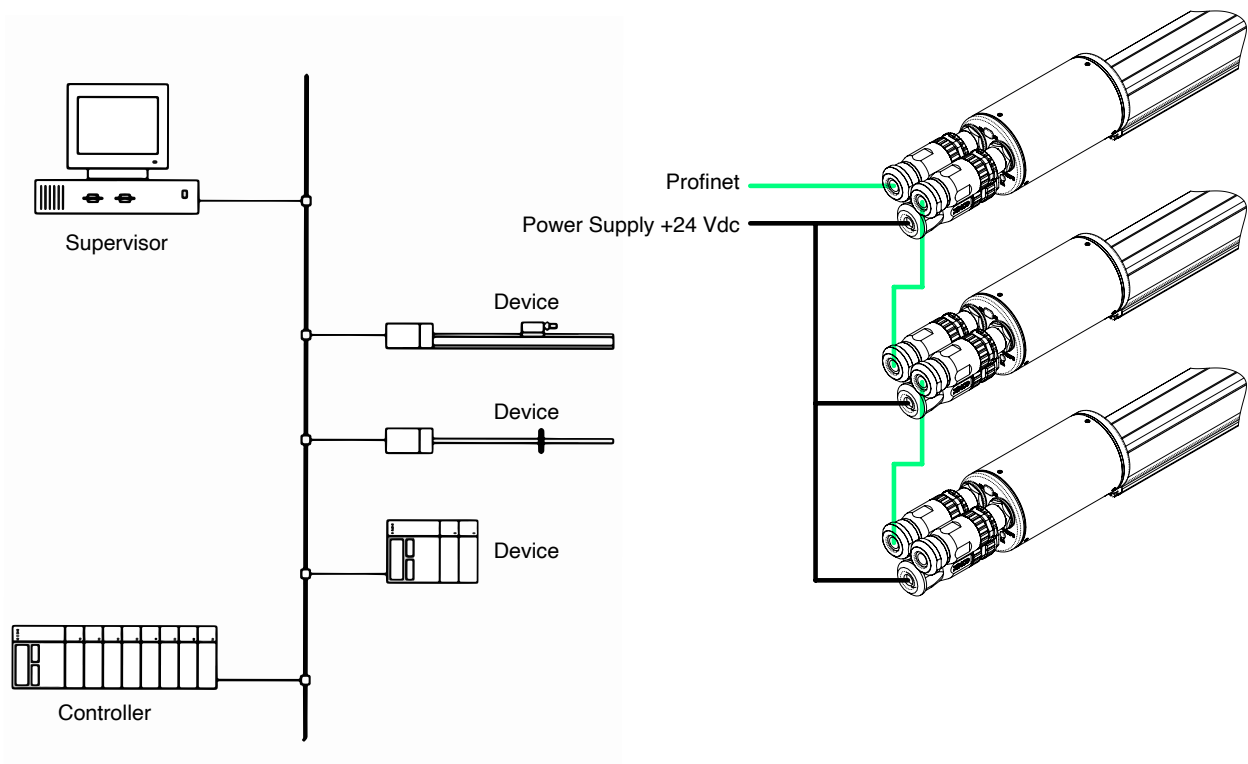
This file allows a clear identification of the device and comprehension of data provided and exchanged.

Please refer to Gefran website for the download of GSDML files.

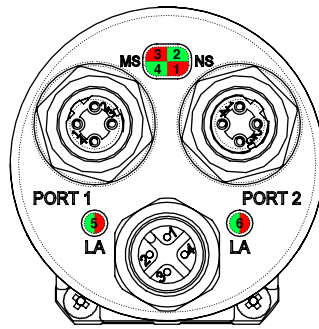
This manual is not designed to describe the "PROFINET" Fieldbus, as it is presumed the user is familiar with the same and will refer

if any updates are required to the above-mentioned standard or the official PROFIBUS CONSORTIUM and PROFINET International

website (PI), <http://www.profibus.com/>.



DIAGNOSTICS OF MODELS WITH LEDS WPA-F / WRA-F SERIES (PROFINET OUTPUT)



Led 1 (Red) Bus Fault	Function
OFF	No error on bus
ON	No connection to controller
Flashing	Waiting for parameterization

Led 2 (Green) System Fault + Signalling	Function
OFF	No system error
ON	Application error
Flashing	Signalling activated

Led 3 (Red) Application error	Function
OFF	No application error
ON Steady	Position error
Flashing 0,5 Hz	Power Supply error
Flashing 1 Hz	Parameterization error
Flashing 2 Hz	Temperature error
Flashing 4 Hz	Internal communication error

Led 4 (Green) Power Supply	Function
OFF	No Power Supply
ON	Power Supply ON

Led 5-6 (Red-Green) Link Activity	Function
OFF	No connection to next port
Green ON	Connection to next port established
Green ON + Red Flashing	Connection to next port established and communication active

DETAILS ON MODELS WITH ETHERCAT OUTPUT (WPA-E/WRA-E)

WPA-E / WRA-E magnetostrictive transducer implements CANopen over EtherCAT (CoE) protocol.

EtherCAT is a digital communication standard developed by Beckhoff and maintained by EtherCAT Technology Group (ETG). The digital communication allows the transfer of data between the Device (the WPA-E/WRA-E transducer) and the Master (PLC) through a network.

These data are:

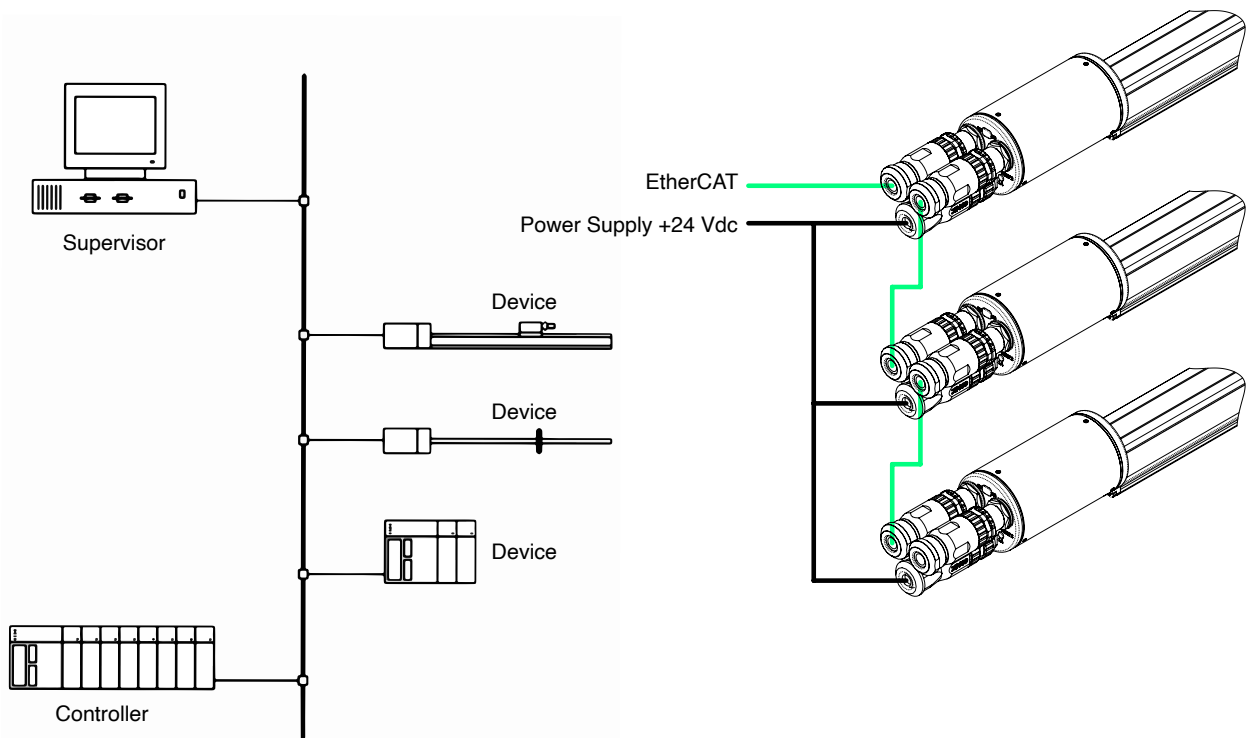
- Process data, such as position, speed, status of the device
- Acyclic data, as parameterization, statistic, diagnostic data

EtherCAT standard provides a descriptor file called ESI (EtherCAT Slave Information, based in XML format).

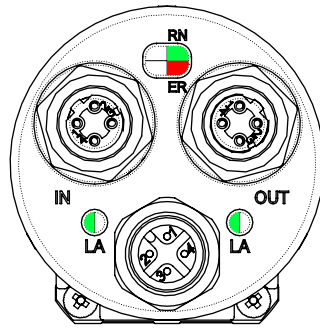
This file allows a clear identification of the device and comprehension of data provided and exchanged.

Please refer to Gefran website for the download of ESI file.

This manual is not designed to describe the EtherCAT protocol, please refer to EtherCAT website (<https://www.ethercat.org/>) for any information about EtherCAT protocol standard.



DIAGNOSTIC OF MODELS WITH LEDs: WPA-E / WRA-E SERIES (ETHERCAT OUTPUT)



RN Led (Green) - RUN	Function
OFF	The device is in state INITIALISATION
Blinking	The device is in state PRE-OPERATIONAL
Single Flash	The device is in state SAFE-OPERATIONAL
ON	The device is in state OPERATIONAL

ERR Led (Red) - ERROR	Function
OFF	No Error
ON	Application controller failure
Double Flash	EtherCAT Watchdog Timeout
Single Flash	Slave device has changed the EtherCAT state autonomously, due to local error
Blinking	Invalid Configuration

IN LA Led (Green) – IN Link Activity	Function
OFF	Port Close
ON	Port Open
Flickering	Port Open and in Activity State

OUT LA Led (Green) – OUT Link Activity	Function
OFF	Port Close
ON	Port Open
Flickering	Port Open and in Activity State

The WPA-E/WRA-E status LEDs are designed in accordance with ETG 1300 Standard.