

MAGER

air bearings

Free to Slide

FLAT AIR BEARINGS AND MORE...

COMPONENTS AND SYSTEMS FOR SLIDE AND MOTION
BASED ON **GAS LUBRICATION TECHNOLOGY**
FOR INDUSTRIAL APPLICATIONS.



No friction, no wear

For maximum energy efficiency and reliability over time

No disturbed motion phenomena

such as *creep, fretting and stick-slip*

No oil or grease lubrication

In absolute compliance with hygiene and environmental standards

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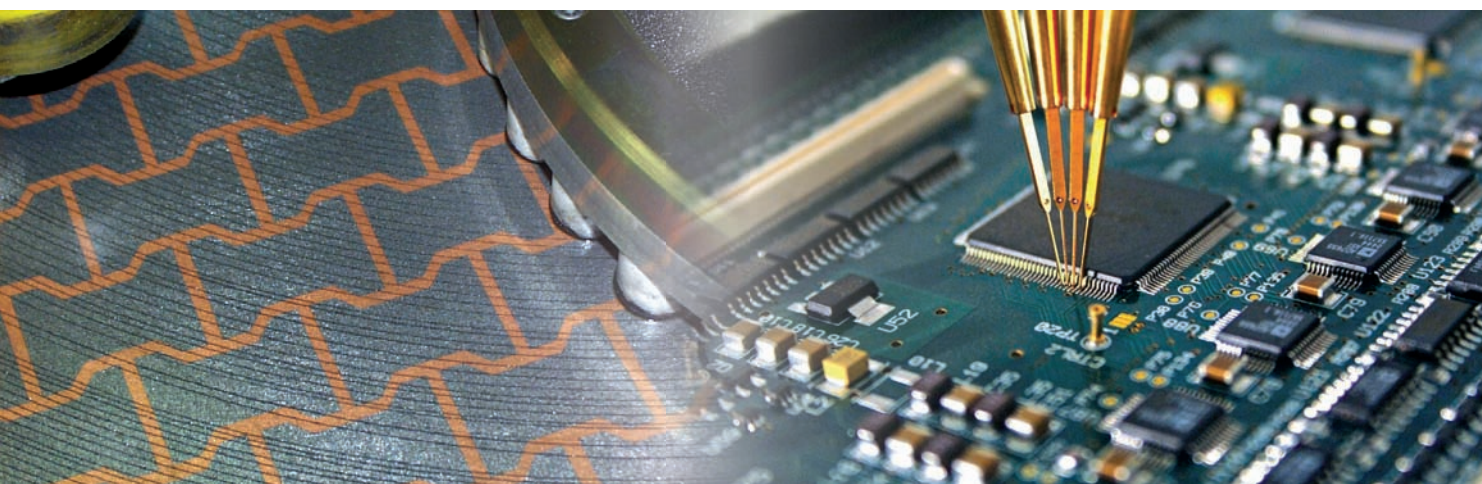
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**THE WINNING ALTERNATIVE
TO SYSTEMS BASED ON
SLIDING AND ROLLING BEARINGS**



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THE COMPANY

Since 1979 **MAGER Air Bearings**, has been involved in the design, development, testing and manufacture of aerostatic systems and components for industrial applications.

MAGER Air Bearings therefore provides complete guide and movement solutions for a wide range of industrial sectors:



In particular, aerostatic applications are widely implemented where the following is required:

- **Highly dynamic movement** on maintenance-free guide systems
- **High precision** positioning and/or measurement
- **No environmental pollution**
- **No noise or vibrations**
- **High temperature/radioactivity**

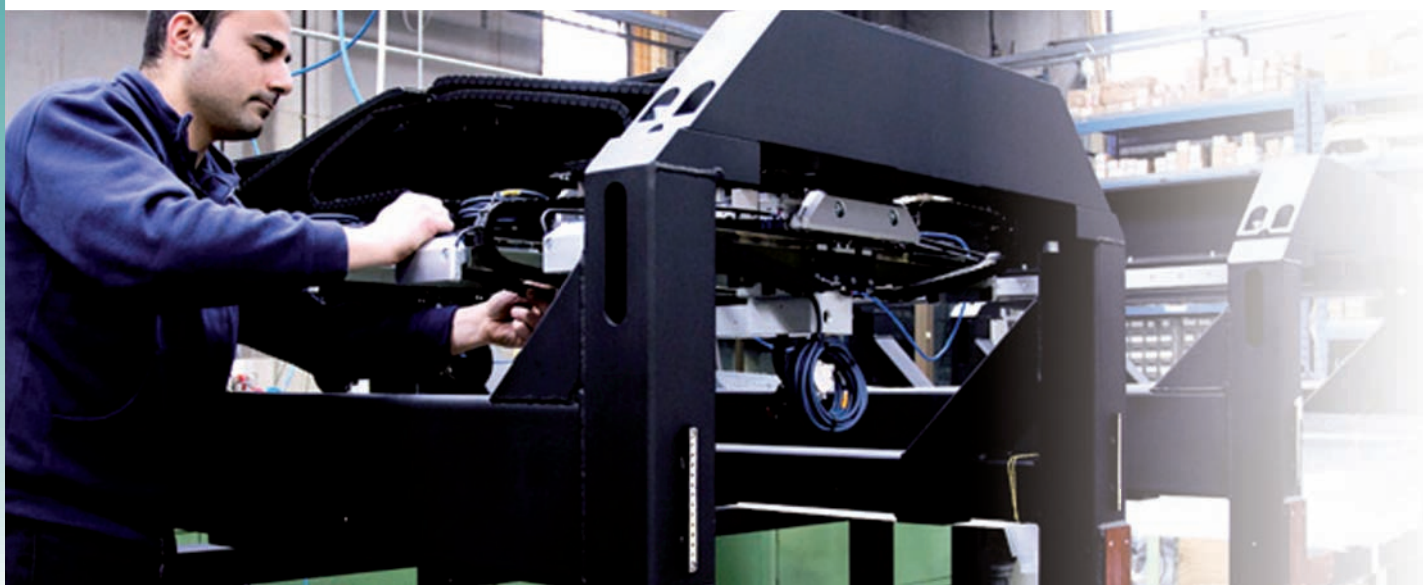
Thanks to business booming over the years **MAGER Air Bearings** acquired an important know-how and thanks to highly qualified staff and modern design, manufacturing and control equipment, it can support its clients through all the manufacturing phases, from definition of specifications to after sales service and assistance.

Depending on each customer specific requirements, MAGER Air Bearings can advise on the application of our standard products or can develop customised parts and systems.

For years, **MAGER Air Bearings** has been successfully integrating the most advanced motorisation and positioning transduction technologies into its products (linear and rotary encoders).

In particular, high efficiency motion is achieved by combining aerostatics with direct drive motorisation (linear motors and torque motors).

MAGER Air Bearings has developed strong skills in this field, positioning itself in the market as a strategic system integrator, availing of parts from various international manufacturers.



MAGER Air Bearings aims for continuous product innovation. Most of its business development leads increasingly towards integrated guides and motors, enhancing the efficiency of industrial motion at the highest levels.

Furthermore, much of the development activities are carried out through funded research and innovation projects both at national and European level.

MAGER Air Bearings is particularly active in the “*Innovation Clusters*” promoted by the Regione Piemonte (*MESAP*, *POLIGHT*), on the strength of the profound conviction that synergy among companies is strategic in the effective innovation of products and technologies.

The company collaborates closely in this field with the main regional research institutes (*Politecnico di Torino*, *INRIM*, etc.).



GAS LUBRICATION TECHNOLOGY

FUNCTIONING PRINCIPLE

The aerostatic guide and support systems use gas, **NORMALLY AIR**, to lubricate them.

For this reason they are called **AIR BEARINGS**.

The air is released under pressure inside the part and, using specific more or less complex diffusers (**nozzles and micro-grooves**), it is distributed among the interacting surfaces.

The slightest layer of air (**meatus**) which is created among them measures just a few thousandths of a millimetre thick and it acts as the lubricant with **the lowest friction coefficient**.

ADVANTAGES



NO wear, absolute reliability and long duration.



High precision positioning control and speed.



Higher accuracies for metrology systems.



High performance for dynamic applications with speed, acceleration and positioning at high frequencies.



NO stroke restraints.



NO vibration

The air bearings have its own damping capacity.

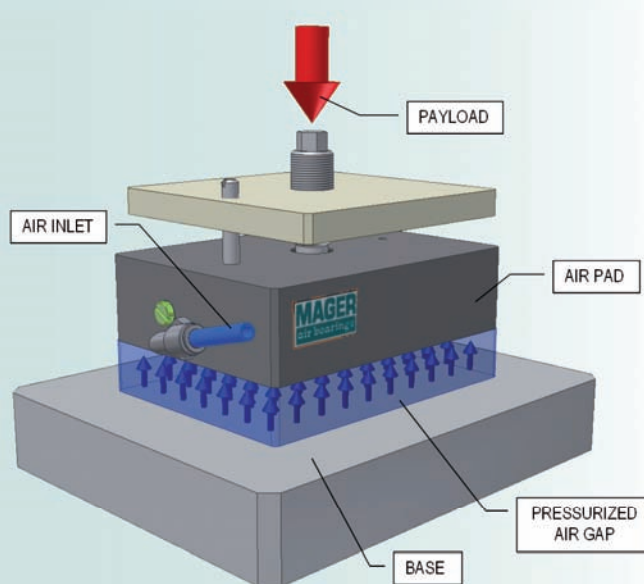


NO pollution

The air bearings are a first choice for applications in “clean rooms.”



Extremely high reliability and performance in environments at high temperatures or in the presence of radiation.



AIR BEARING ADVANTAGES

AIR BEARINGS WHY YES

A correctly dimensioned air bearing guarantees the stability of the air meatus and therefore of the lubrication also at very high speed values, accelerations and frequencies of positioning.

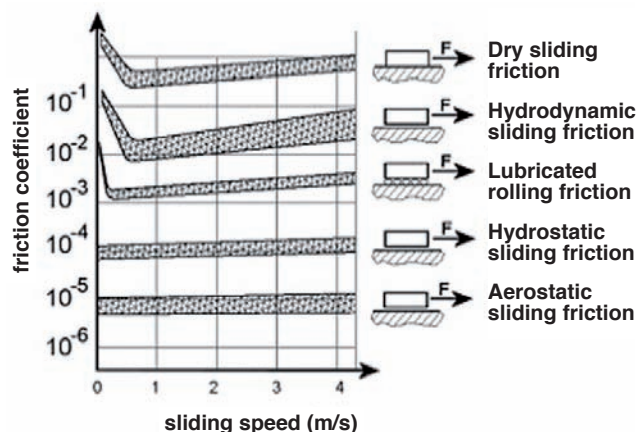
- No wear, absolute reliability and long duration
- No stroke restraints

In the air bearings do not exist creep and stick-slip phenomena: there is no mechanical contact and consequently no wear among the sliding elements even with high speed, accelerations and positioning frequency.

The guide systems are highly reliable and durable, with limited or no maintenance.

Friction is significantly lower than friction in sliding and rolling bearings, and it is also much lower than the typical friction of hydraulic couplings, enabling to reduce the power required.

In contrast to the caged rollers systems, air bearings feature no intrinsic limit in operating runs.



IN CASE OF: HIGH DYNAMICS ON MAINTENANCE FREE GUIDE SYSTEMS

ROLLING BEARINGS WHY NO

As the inversion frequencies of motion and accelerations increase, the behaviour and therefore the life of the rolling bearings is similar to that of NON-lubricated sliding bearings.

- Early wear, compromised reliability
- Significant restraints on useful strokes

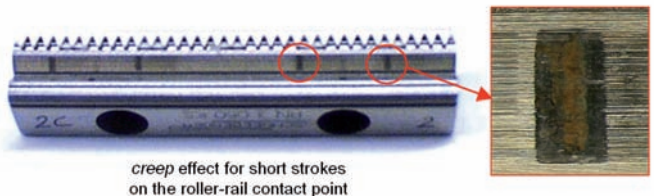
Sliding and rolling bearings suffer from creep and stick-slip.

What is creep? Creep is a parasitic effect of the traditional rolling bearings (spheres or rollers). Stick-slip occurs at the beginning of the movement, causing a temporary drag (sliding friction) between the rolling element (roller or ball) and the track on which the element slides, before the element starts rolling (rolling friction).

Creep becomes more significant as the frequency of motion inversion and acceleration increases, since the loads are higher and the distance travelled by the rolling element in sliding friction condition before it starts rolling, increases.

For accelerations up to 10g, in rolling systems the reduction of damages due to creep depends on lubrication efficiency (with grease or oil), which must be periodically restored.

For very high dynamics, the layer of grease or oil breaks down, causing metal on metal contact and reducing significantly the durability due to premature wear of the parts.



IN CASE OF: HIGH PRECISION POSITIONING AND/OR MEASUREMENT

Air bearings enable higher measurement precision, higher positioning and speed control.

Air bearings, thanks to the low viscosity of air, feature very low, constant friction. Movement is very fluid, and actuation can achieve accurate positioning without difficulties.

The air gap can also "corrects" small shape errors, due to waviness and roughness, of the guides on which it slides, be they linear or rotary, avoiding microjams and partly compensating the shape errors of the guide systems, increasing their accuracy.

Using rolling bearings, extremely high precision positioning and accurate speed control is quite difficult.

Due to creep effect, as motion starts (and in opposite direction to the positioning end) a rolling part meets 3 (not only 2) decreasing friction coefficient values: static sliding friction (first detachment friction, known as stick-slip), kinetic sliding friction and rolling friction.

This means that at very low speeds, near zero, the friction force of the rolling guide system changes, making precision positioning quite difficult: it is as if you'd try to stop your car in a specific point with an engine brake which, when the machine is almost still, suddenly increases its power.

Positioning control relies on motors power and on the readiness of the actuators used. Finally, in radial bearings the roller or ball rotation, due to imperceptible unevenness, can lead to microjams, which affect measurements, positioning control and speed.

IN CASE OF: NEED FOR ABSENCE OF ENVIRONMENTAL POLLUTION

Air bearings **DO NOT** pollute. They are the priority choice for "clean-room" applications.

The lubricant in aerostatic application is suitably filtered, deoiled, dehumidified air. Such air has no polluting power.

Besides, with no wear between parts, no dust is generated.

A further benefit is the pressurization of the environments due to the air supplied to the air bearings which escapes from the air gaps.

This enables air tight environments, protected from dust.



Systems based on rolling technology may significantly pollute particular working environments.

The presence of oils or greases is highly polluting: in case of high dynamics there may be significant overheating which in turn may cause the evaporation of the lubricants. Besides, if lubrication is poor, metal wear on parts may produce dusts. Such pollution may not be acceptable in different industries, for several reasons.

sector / purpose	sanitary grounds	alterations of the product / sample specifications
chemical		X
biological	X	X
pharmaceutical	X	X
medical	X	X
food industry	X	X
paper / graphics		X
electronics / optical		X

Generally, the guide systems may require optical transducers (photodiodes, lasers, etc.): the deposit of the lubricant vapours on the optic components over time may alter their performance, up to complete malfunctioning.

In case of hydraulic systems or hydrostatic systems, leaks of water or oil cannot be avoided, and it is necessary to set up a system so as to recover and recycle the fluids.

IN CASE OF: LOW NOISE AND ABSENCE OF VIBRATIONS

Air bearings are very quiet and have limited vibrations, independent by the dynamic system.

The air gap avoids the contact between rigid parts: the noise is limited to the hiss of air escaping from air gaps.

Moreover, air has a damping effect, which absorbs the vibrations in a specific range of frequencies.

Systems based on rolling technology may feature unacceptable noise and vibrations depending on the dynamic system.

Creep and stick-slip effects generate noise and vibrations, due to the high rigidity of the contact combined with the difficulty to control the movement: at high frequencies, this may become a quite important design parameter. Due to the recirculation effect, the continuous change of the number of the elements (spheres or rollers) on contact on the rail, creates itself drive vibrations.

IN CASE OF: HIGH TEMPERATURES AND / OR RADIOACTIVITY

Air bearings are reliable even with high temperatures and radioactive sources.

Air viscosity virtually does not change as the temperature changes, and it is not sensitive to radioactivity: the aerostatic systems ensure maximum reliability even in difficult environmental conditions.

The durability of systems based on rolling technology with high temperatures and radioactive sources may be limited.

The durability of the parts in the rolling guide system decreases significantly when the operating temperature increases, because there is a decay of the mechanical characteristics of the metals (surface strength, stress resistance) and of the lubrication effectiveness of oils and greases.

The latter are quite sensitive to radioactivity as well.



PRODUCTS OVERVIEW

LINEAR SYSTEMS

MAGER Air Bearings can propose various linear guide solutions, the result of experience gained throughout 20 years of applications in this field.

The proposals range from simple **flat air bearings** to complete **cartesian linear guide systems**.

FLAT AIR BEARINGS • HPR / HPC series for precision applications

The **HPR e HPC series (High Precision Rectangular e Circular)** can be used when light and precise guide and support systems are necessary. Their versatile use enables the planner to solve even the most complex problems.

They can be used in a wide range of applications:

- Guide systems for metrology/quality control (*CMM, optical tests, etc.*)
- Machine tools for light machining (*laser, micro-milling, etc.*)

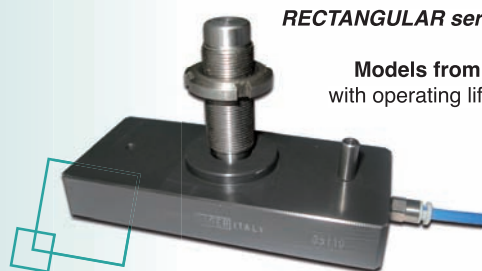
FEATURES

The new series of HPR and HPC flat air bearings are manufactured in aluminium with a hard anodized treatment and are normally supplied with an adjustable spherical screw pin, a locking ring nut and an anti-rotation pin.

They can also be combined with non adjustable spherical pins.

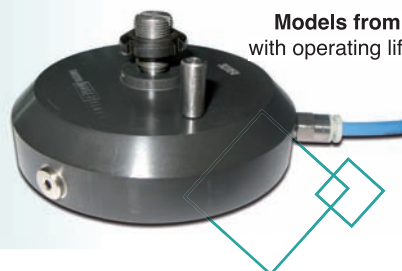
The rectangular HPR series guides are preferred to the HPC guides when a more favourable lift force-dimensions ratio is required.

The broad versatility of the design/manufacturing system used by **MAGER Air Bearings** enables **PRODUCT CUSTOMISATION**, if necessary, on each customer applications.



RECTANGULAR series (HPR 1...5)

Models from 12 to 632 daN
with operating lift force @ 4 bar



CIRCULAR series (HPC 1...4)

Models from 21 to 620 daN
with operating lift force @ 4 bar

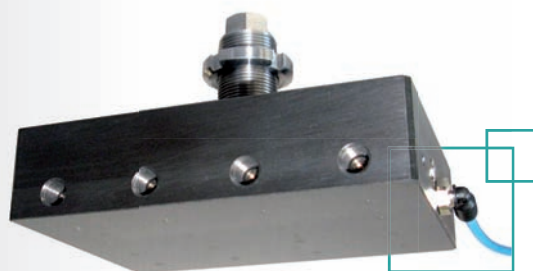
FLAT AIR BEARINGS • HRA series for heavy duty applications

The **HRA series (High Resistance Aluminium)** is ideally applied to heavy weight or inertia of motion systems, where it is necessary and sufficient to minimize the friction forces and therefore the forces applied for motion operations.

Their use is recommended in the following conditions:

- High static and dynamic forces (*also over a ton*)
- Elevated dimensional and geometrical errors on sliding guides
- Solid, liquid or gaseous pollutants (*dust and scrap from machining, lubricating oils and grease, process and protection gases*)
- High temperatures

They are manufactured using aluminium with an anodised surface treatment and equipped with a dense air distribution network on the work surface. These features make the air bearings particularly efficient, even on particularly irregular surfaces with dimensions and roughness over 1.6 micrometres.



Models from 158 to over 1.010 daN
with operating lift force @ 5 bar

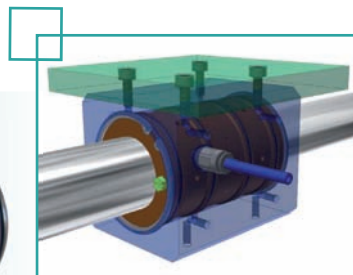
BUSHING LINEAR GUIDES • PB series

The **PB series (Aerostatic Bushing)** bushing linear guides are intended for use on linear movements requiring friction to be eliminated.

FEATURES

They are composed of an aerostatic bushing in bronze or anodised aluminium and a connection sleeve. Sliding takes place on calibrated, chrome round sections.

Available in various sizes with radial lift forces from 50N to 1.300N.



CAD Complete Linear Guide.

DOVETAIL GUIDES • LS series

Intended for use on linear systems in dimensional metrology and dynamic metrology.

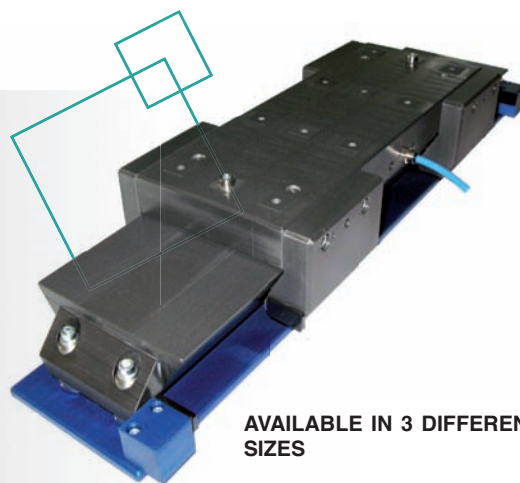
Being characterized by very low sliding friction, they find their best application in force and parasitic friction measurement in industrial parts (example: seal friction on pneumatic actuators, reaction engine thrust testing).

FEATURES

The dovetail guides are manufactured in aluminium with a thick, hard oxidation surface treatment.

The slides have built-in HPR series air bearings.

The nominal strokes available range from a minimum of 50mm to over 1,000mm.



AVAILABLE IN 3 DIFFERENT SIZES

LINEAR MOTORISED AEROSTATIC SYSTEMS • LMP / LMP-s series

The **LMP series (Linear Motion) motorised aerostatic linear guide systems** solve numerous precision positioning problems.

Depending on the final application, they can be configured in various ways:

- on air bearings with hard fastening, with adjustable pivot or without or built-into the slide structure
- with opposing slides, with magnetic pre-loading or vacuum
- with belt motorisation, with recirculation ball screw, in direct drive (linear motors)
- with magnetic or optical linear encoders
- with light protective casing or pressurised seal
- with steel, anodized aluminium, granite guides
- with guides coated with anti-friction material (Turcite or PTFE+graphite)

The **standard LMP-S series**, is manufactured using:

- Built-in aerostatic slides
- Direct drive
- High resolution linear optical encoders

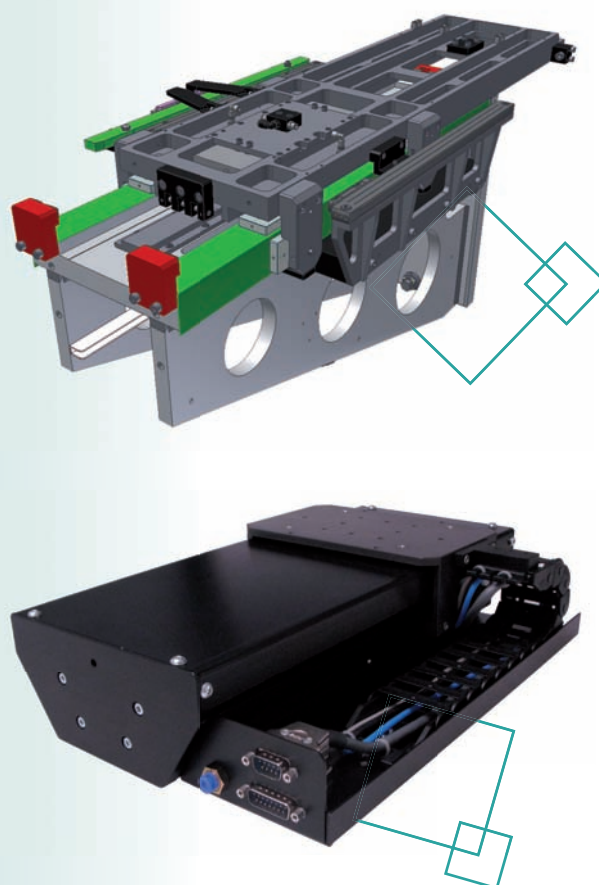
The **LMP Series** represents the best combination of dynamics, precision, reliability and versatility: fast and very accurate positioning is enabled, as well as consistent performance over time.

The slides are available in **3 different sizes**, and can implement up to **3 different types of linear motors**. The nominal strokes available vary from a minimum of 156mm to a maximum of 968mm.

Superior strokes are available on request.

The LMP guide systems can be used as **stand alone linear systems** or in different **X/Y or X/Y/Z combinations/architecture**.

Aerostatic rotary tables from the motorized TG series can be assembled on the sliding block as well.



LINEAR HIGH DYNAMIC ACTUATORS • LHD series

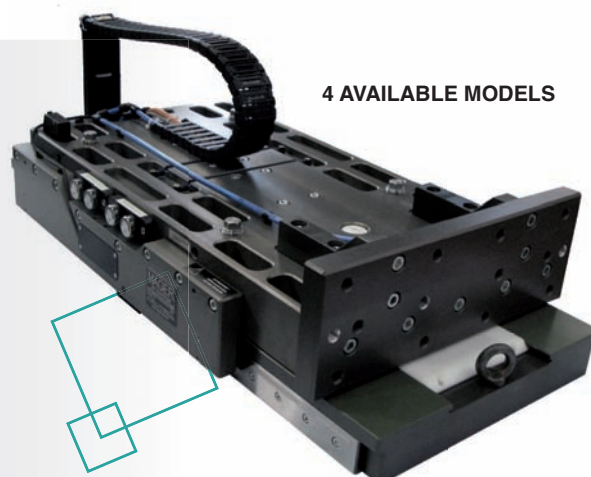
The **LHD series (Linear High Dynamic) actuators** is suitable for masses and/or tools with high frequency which need to be moved on short strokes, maintaining considerable positioning precision, and thus functioning in all effects as a high performance electronic cam.

The performances of the actuator can also be defined by controlling the force developed.

FEATURES

- Anodised aluminium structure
- Direct drive (ironcore linear motor)
- Positioning transduction using an optical linear encoder

The versions with aerostatic support guides are longer lasting and more reliable since they are NOT subject to creep phenomenon (typical of rolling systems), which is particularly important with high frequencies of motion inversion.



4 AVAILABLE MODELS

XY CARTESIAN MOTION SYSTEMS • LDCH series

The **LDCH (Linear Direct-drive Cross-centered Hybrid) motorised guide system** is a XY cartesian linear guide system with direct linear motorisation; it is reliable and precise. It is based on cross-centred architecture.

It has an aerostatic guide on the Y axis and a hybrid guide (*the support guide is pneumostatic, while the lateral guide is rolling*) on the X axis, allowing greater stiffness and compactness in X direction.

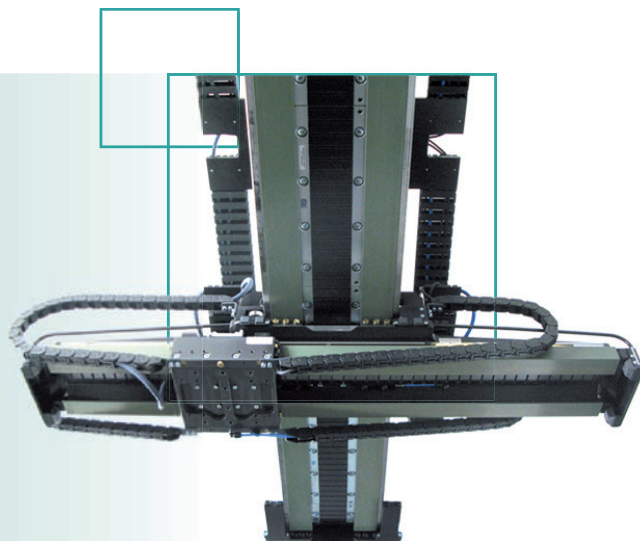
It can be used to move the tool and/or measurement heads up to 3kg in weight and up to 2g in acceleration.

Positioning transduction takes place using linear optical encoders.

The working area, variable on X, is X300-1000mm x Y600mm.

Two or more Y axes can be simultaneously assembled on a single X axis.

The system is available in 2 sizes, with configurable strokes.



XY CARTESIAN MOTION SYSTEMS • LMVX series

The **motorised linear guide LMVX series system (Linear Motorised Volvent X-cross)** is a XY system with cross-centred architecture and direct linear motorisation, suitable to move tool or measurement heads (laser and optical laser heads, handling devices and pick & place, heads, cameras) weighing up to 2kg.

It can be easily integrated with frames and bases manufactured by the customer, according to his specific requirements.

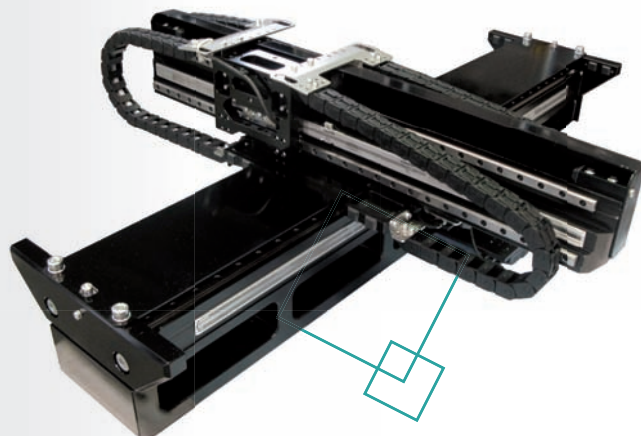
Unlike the LMP and LDCH series, which use aerostatic guides, the LMVX series uses rolling linear guides and it is an excellent compromise between performance (*up to 2g acceleration*), cost savings and compactness.

The system is already equipped with **direct linear motorisation** (*iron-core on X axis and ironless on Y axis*) and a **positioning transducer** (*linear optical encoder*).

The drives and control card for the axes are optional.

Multiple Y axes can be assembled on a single X axis.

The working area varies from a minimum of 271x248mm to a maximum of 1167x632mm.



METROLOGICAL COLUMNS • CM series

The sensor support metrological columns in the **CM series** are mostly intended to be used with rotary tables (*TG series*) if you have to create a roundmeter to conduct straightness and cylindricity controls.

The transfer slide is aerostatic with built-in air bearings and magnetic contrast pre-loading.

They are equipped with a cc gear motor, belt drive and linear optical encoder to control altimetric positioning.

2 sizes available:

Stroke • 300mm

Stroke • 500mm



ROTATIVE SYSTEMS

MAGER Air Bearings rotary guide systems combine high rotation precision with minimum friction torque. They are best applied in the **metrological** and **quality control sectors**.

The products range from rotary tables with or without a hollow shaft to aerostatic pulleys and spindles and radial and radial/axial bushings.

On request, we can integrate **motorisation devices** (*CC gear motors or PP motors with belt or toothed wheel drive, torque motors*) or **angular transduction** (*rotary or ring modulator encoders*).

The broad versatility of the design/manufacturing system used by **MAGER Air Bearings** enables product customisation, if necessary, based on the customer specific application.

ROTARY TABLES • TG series

The aerostatic rotary tables **TG series** are characterized by high precision rotation. They are suitable for precision applications, as in the following cases:

- Metrology of lengths and forces
- Positioning of the operating machines (*laser, micro-machining*)
- Electronics and semi-conductors sector

FEATURES

- Air bearing both in axial and in radial direction
- High rotation precision
- Fairly wide ranging load and stiffness capacity

The standard series is available in 4 sizes, Ø upper support bearing diameters ranging from 125mm to 500mm.

Axial load ranges from 25 to 2.700 daN operating lift force.

Unless otherwise specified, the relative supply pressure is 5 bar.

The tables can be configured with motorisation/drive and a rotary encoder.

Other versions are available with:

- **a through-hole shaft** (*to pass cables and equipment*)
- **a levelling and centring table** (*typically for roundness testers tables*)



RADIAL AND RADIAL/AXIAL ROTARY SYSTEMS • TR series

MAGER Air Bearings offers radial rotary guide systems where the rotation axis is horizontally oriented and the bearings are ad hoc dimensioned to support the predominant radial stresses.

They can be used in a wide range of final applications:

- Null friction idle guide torque measurements
- Tilting axis for the 4th axis for light machining
- Metrology systems

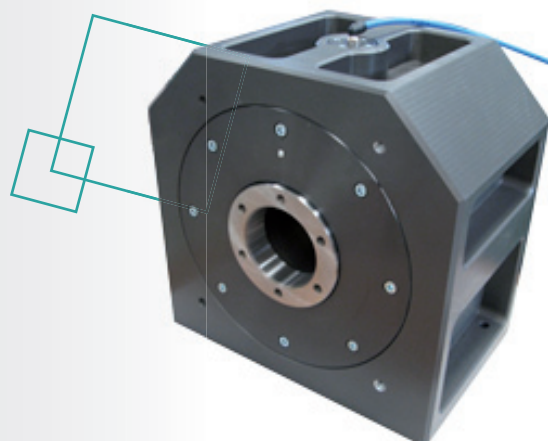
FEATURES

The **TR systems** have various configurations:

- Single axis (**TR series**) and with dual concentric axis (**TRD series**)
- With air bearings (*for torque measurements, metrology and micro-machining*) or rolling bearings (*for applications with medium precision heavy loads*)
- Idle systems (*guide only*) or motorised systems (*mainly direct drive - torque motors*)

The guide systems with air bearings can be supplied with the following configurations:

- **Radial only**: the shaft is free to slide axially for a few mm
- **Radial-axial**: the shaft has axial constraints with thrust support aerostatic discs.



COMBINED SYSTEMS

The drive systems are combined multi-axis systems that combine linear guide with rotary guide, both motorised.

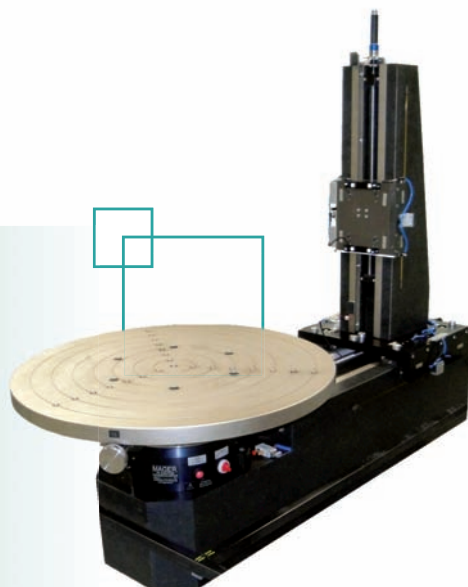
The configurability is high, as well as performance in terms of speed and positioning accuracy.

ROUNDNESS TESTERS MOTORISED SYSTEMS

The motorised guide systems for roundness testers are characterized by:

- a motorised aerostatic rotary table from the TG series, with high precision rotation (*radial run-out* $< 1\mu\text{m}$), and direct or indirect drive (*torque motor*).
- a metrological column with X and Z movement on linear guides with aerostatic slides and straight granite guides ($< 2\mu\text{m}$), with indirect drive (*recirculation screws*) or direct drive (*linear motors*).

Strokes and supported useful loads can be configured according to the requirements of the final customer.

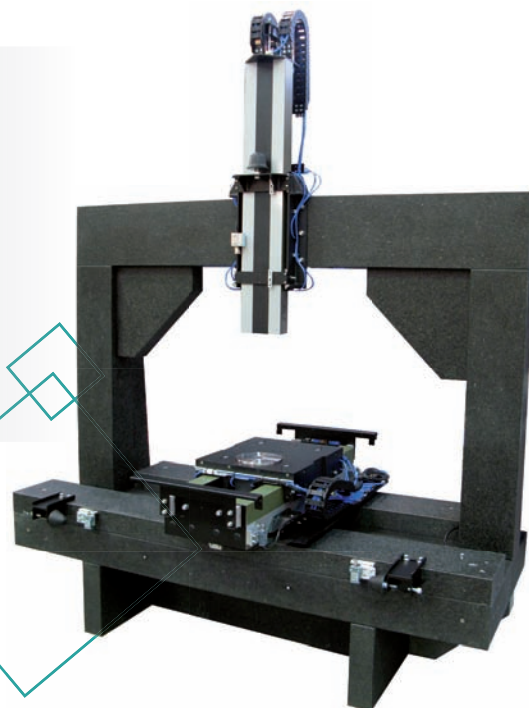
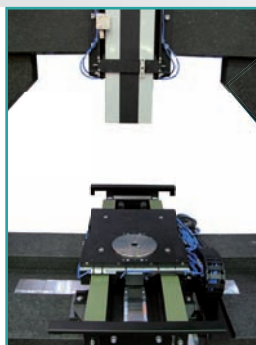
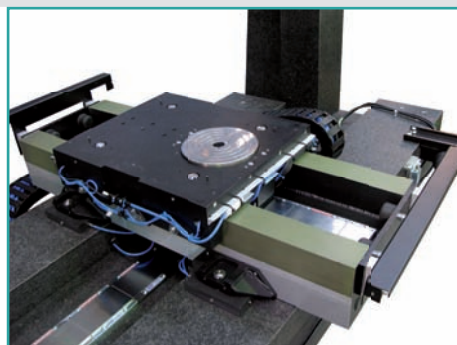


MICROMACHINING MOTORISED SYSTEMS

Multi-axis systems designed for laser micro-machining sector and high speed tools.

The guide system is characterized by:

- **XYZ linear axes** on aerostatic slides, with direct drive, and high resolution linear encoders. The Z axis is a mobile guide, to offer the best access to the volumes of machining planned.
- **Rotary axes:** the 4th axis (or A axis) built into the XY motion slide, TG series table with a radial-axial guide on the air bearing, **direct drive** and **modular, high resolution encoder**.



SPECIAL SYSTEMS

Throughout these years there have been numerous requests from buyers of special products, regularly and fully satisfied requests.

They range from the development of special flat air bearings (*high lift, rather than specific materials,...*), up to metrology applications and automation applications where high performance and customisation are required.

SPECIAL FLAT AIR BEARINGS

MAGER Air Bearings develops special flat air bearings according to specific customer requirements:

- Large flat air bearings with lift more than a ton.
- Flat air bearings based on drawing / customer specifications made of different materials: aluminum, steel, bronze, brass.
- Flat air bearings based on drawing / customer specifications, with special shapes.



PRIMARY HARDNESS TESTERS SYSTEMS

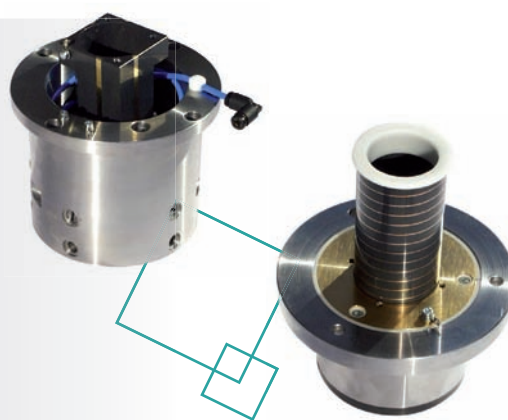
The vertical guide system for primary hardness testers developed by **MAGER Air Bearings** enables a drastic reduction in the forces of parasitic friction that impacts on hardness measurements.

The system is composed by:

- an upper square (*anti-rotation*) aerostatic guide unit
- a lower cylindrical aerostatic guide unit.

An electrical circuit built into the sliding guides enables the presence of the air meatus to be detected and therefore the quality of the measurement.

It is advised to combine this guide system with the **PLG pulley series**, so as to drive counterweighing of the durometer loading system without parasitic friction.



AEROSTATIC PULLEYS • PLG series

They are used to drive belts and ropes with very low friction torques. Ideal for counterweight systems in metrological devices.

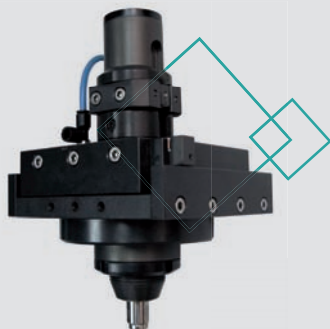
A typical application is in durametric sampling machines, for which **MAGER Air Bearings** can also supply a **specific vertical guide system**.

6 MODELS from 11 to 25 daN with an operating radial lift force of **4 bar**.

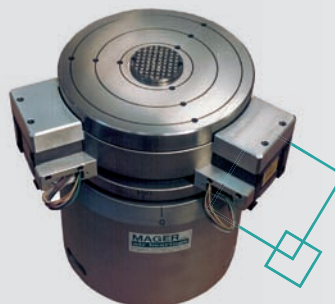


CUSTOM-MADE SYSTEMS

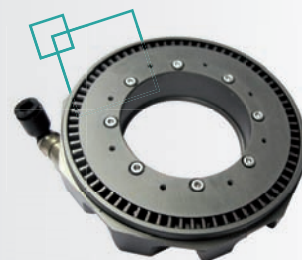
Over the years, **MAGER Air Bearings** has developed a considerable series of products destined for special applications.



Short stroke (**8mm**) aerostatically multi-axis (XYZ) guide system for prototype probe in continuous for coordinate measuring machines.



Aerostatic rotary table with special equipment for spatial orientation of silicon crystals samples for new generation mass sample.



High-speed pneumatic turbine system device with air bearings for radial and axial guide.

CONTACTS

For further information about our company or products do not hesitate to contact us. We will be delighted to meet your needs.

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HOW TO REACH US



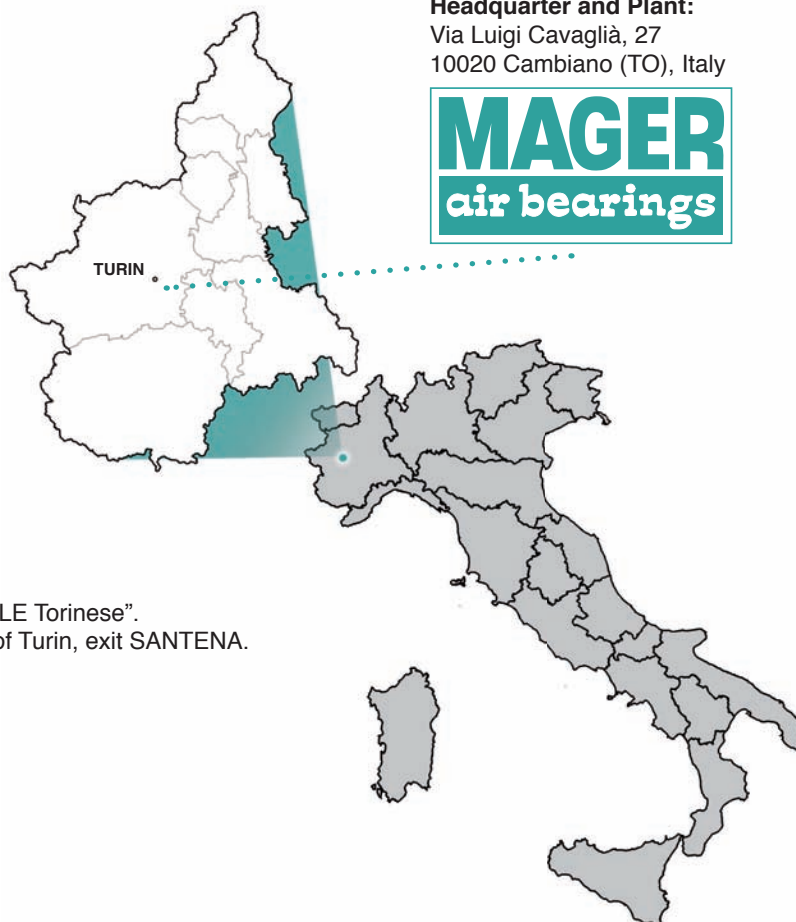
By car: TANGENZIALE SUD of Turin, exit SANTENA. Continue in the direction CAMBIANO on via Nazionale.



By train: RAILWAY STATION "CAMBIANO/SANTENA" on via Nazionale.



By plane: AIRPORT of TURIN "CASELLE Torinese". Than continue to TANGENZIALE SUD of Turin, exit SANTENA.

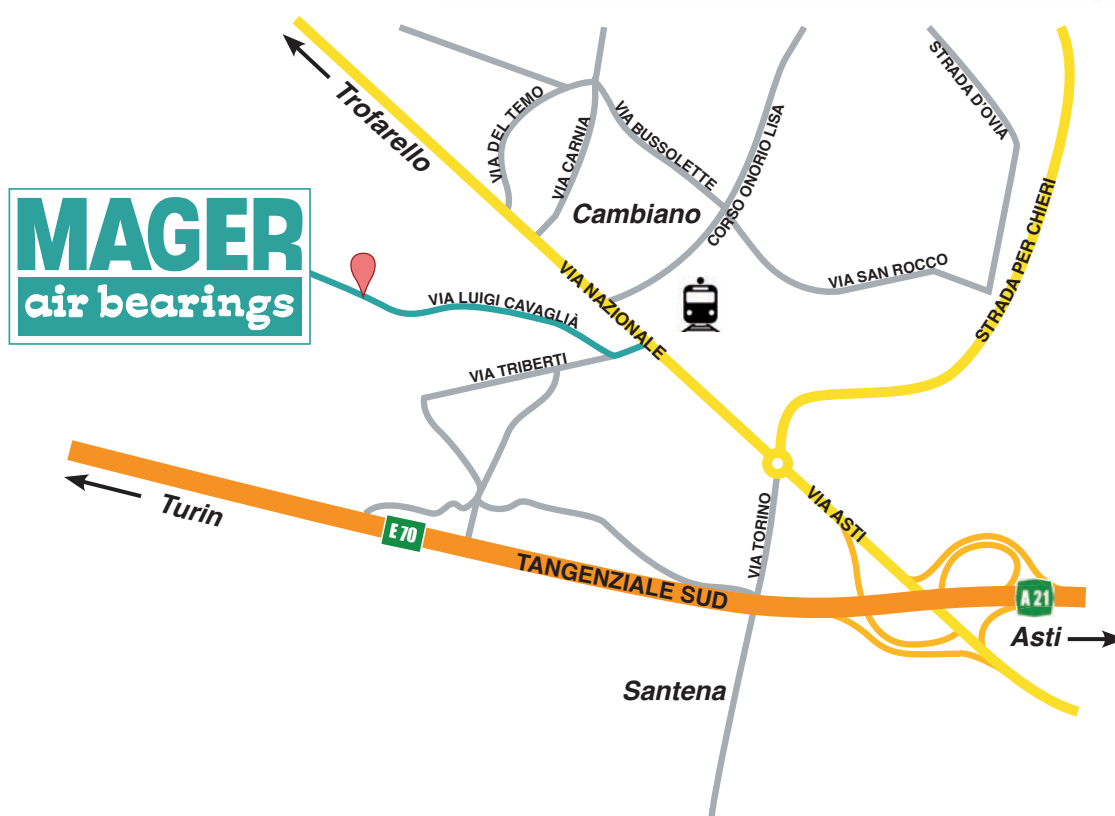


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