ELECTRICITY INSTEAD OF AIR

Replacement of pneumatic cylinders by industrial linear motors

Smart solutions are driven by

LinMot®


LinMot®

Focus on CO_2 emissions

ENERGY REQUIREMENTS FOR PNEUMATICS

According to EU studies, the energy efficiency of pneumatic drives is around 5%. For compressed air preparation alone, 80TWh of electrical energy is required per year in Europe. This corresponds to the output of 7.5 nuclear power plants.

TWO AND A HALF TIMES AROUND EARTH

If the CO_2 emissions of the pneumatic cylinder are compared with the emissions of a modern passenger car (120g/km), this would correspond to an annual driving distance of 100›000km. However, if the application is realized with an industrial linear motor, the CO2 emission corresponds to a distance of only 3›000km per year.

RISING ENERGY PRICES

From 2009 to 2019, the price of electricity for industrial consumers in Europe rose by more than 30% in ten years. Experts expect this trend to continue in the coming years. This inevitably means that the need for energy-saving machinery and equipment will become increasingly important.

CO2 EFFLUENCES

In Germany, around 64% of electricity is still produced using fossil fuels. According to a study by the Fraunhofer Institute, CO_2 emissions in coal-fired power plants amount to 980g per kWh of energy produced and in gas-fired power plants it is 515g CO_2/kWh. For the positioning task listed below, this means annual CO_2 emissions of more than 12 tons per pneumatic cylinder.

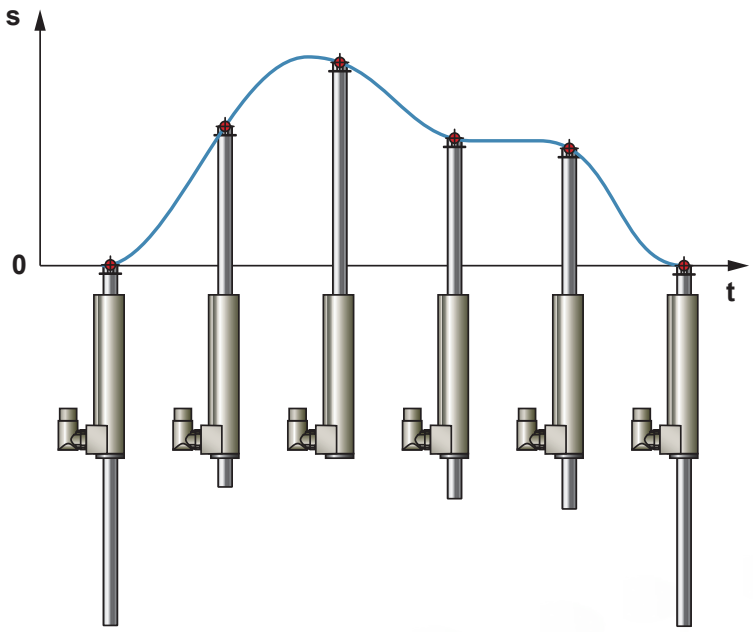
Replacing pneumatics

Pneumatic cylinders are increasingly being replaced by linear industrial motors due to their high operating costs.

Especially when more than two positions are required, when positions need to be changed by software, when motions are synchronized to a main drive, or when the dynamics and service life of a pneumatic cylinder are simply not sufficient, designers gladly turn to linear direct drives from LinMot.
Due to high operating costs for pneumatics, the use of industrial linear motors pays off to an increasing degree, even for simple point-to-point motions with only two end positions.
This is especially true when motions are performed regularly in cyclical operations, and pneumatic cylinders need to be oversized due to speed and load conditions. In this case, the energy and maintenance costs exceed the investment costs within a few weeks.

SIMPLE START-UP

By integrating the control of position, speed, acceleration, and force, commissioning is made much easier. Motion parameters are calculated when the project is laid out, and can be adopted directly during commissioning.

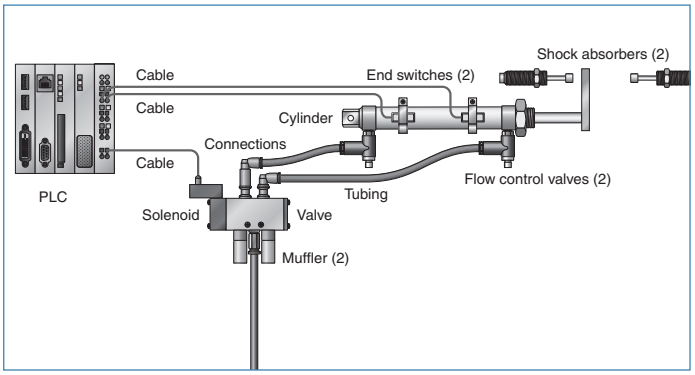


IMPROVED PROCESS STABILITY

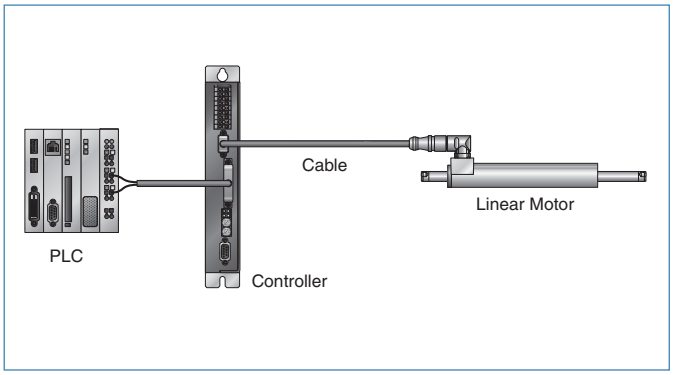
Unlike pneumatic cylinders, where only the end positions are checked, the position of a linear motor is constantly controlled and monitored. This leads to much greater process stability, because very small deviations can be detected when needed.

Industrial linear motors reduce the number of components required and greatly increase system flexibility.

PNEUMATICS: MANY COMPONENTS

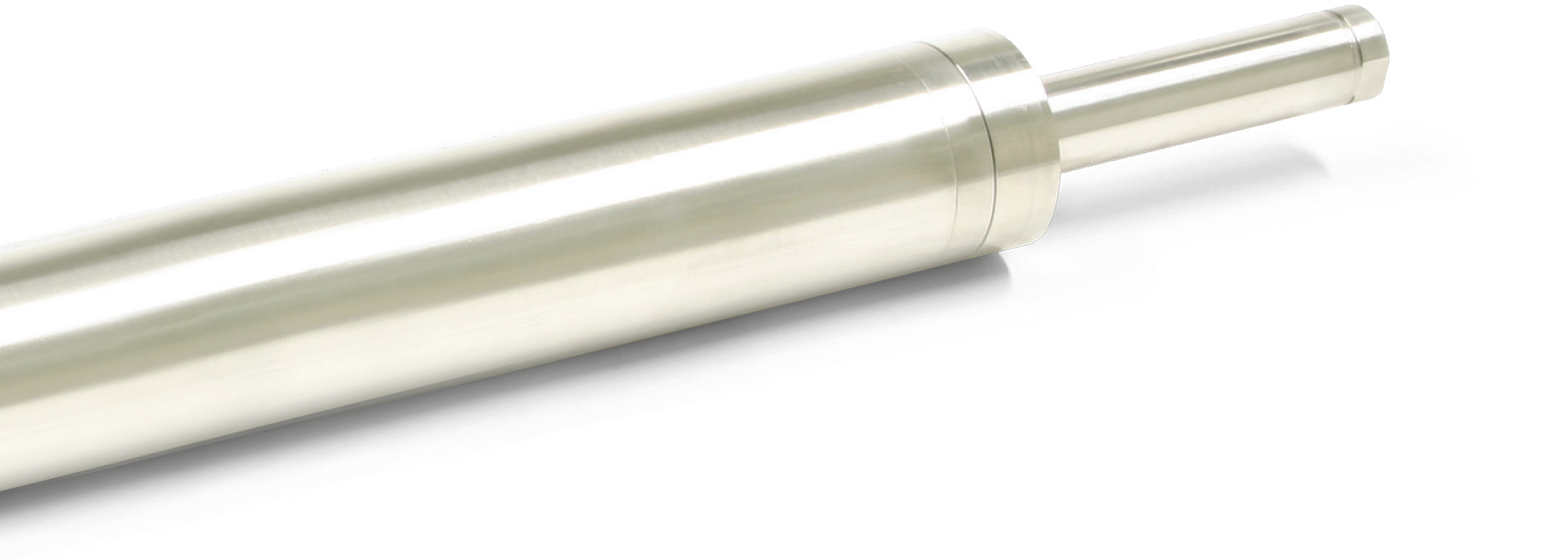


LINEAR MOTORS: FEW COMPONENTS



SIMILAR CONFIGURATION MAKES REPLACEMENT EASY

Industrial linear motors have a cylindrical form factor and similar dimensions to pneumatic cylinders. For this reason, they are commonly used as replacements for pneumatic actuators in existing and new designs.



ADVANTAGES OF INDUSTRIAL LINEAR MOTORS

- Freely positionable
- Extremely dynamic
- Long Service Life
- Adjustable speed
- Monitored motions
- Low maintenance costs
- Adjustable acceleration
- Gentle motions
- Hygiene (no air)
- Programmable force
- Synchronization capability
- Low energy costs

LinMot®

Electricity instead of air

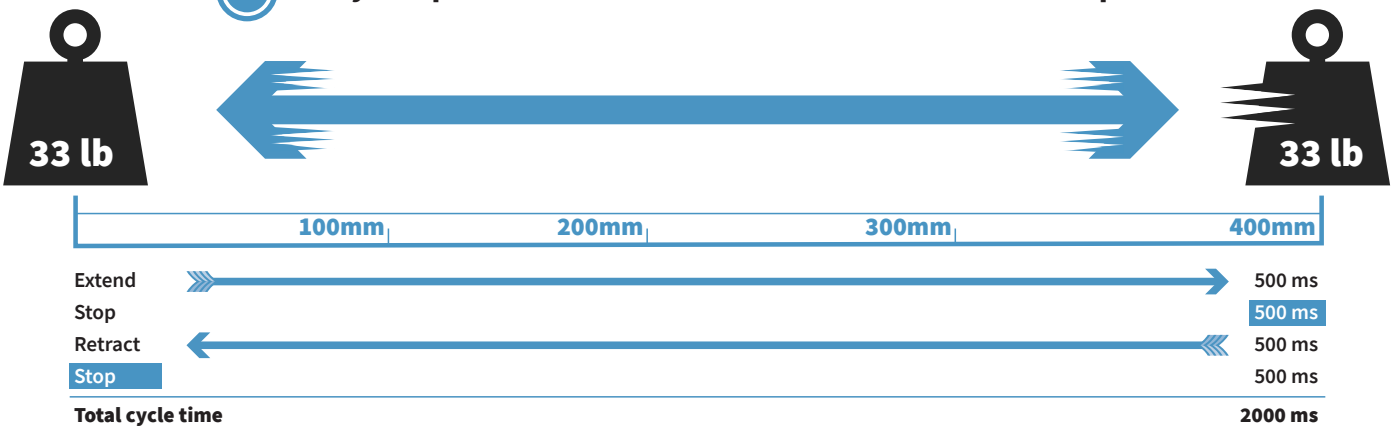
Energy and cost savings using a practical example

Application

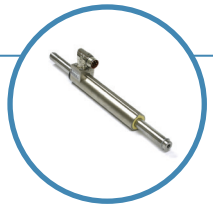
Parameter

Stroke:	400 mm	Required speed:	1 m/s
Positioning time:	500 ms	Expected period of operation:	8000 h
Required acceleration:	10 m/s2		

30 cycles per minute with 500 ms travel time an 500 ms pause

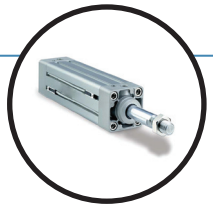


Comparison of technology



Linear Motors

- Acceleration work is performed only during 100 ms.
- At standstill, no energy is expended.
- At a constant speed, only energy to overcome the friction is used.
- Kinetic energy is stored in the DC link capacitor of the servo drives.
- **The measured power consumption for this application is 92 W on average.**



Pneumatic cylinder

- For the required mass and velocity a piston diameter of 50 mm is required.
- During the entire moving time, compressed air power is required.
- Dampers absorb the energy during braking. The energy cannot be stored.
- Due to the cylinder diameter, the stroke and the cycle time the annual air requirement equals 150.000 Nm^3 per year.
- Pneumatic manufacturers list production costs for compressed air at 0.025 EUR/Nm^3.

Vergleich der Energiekosten

Linear Motors

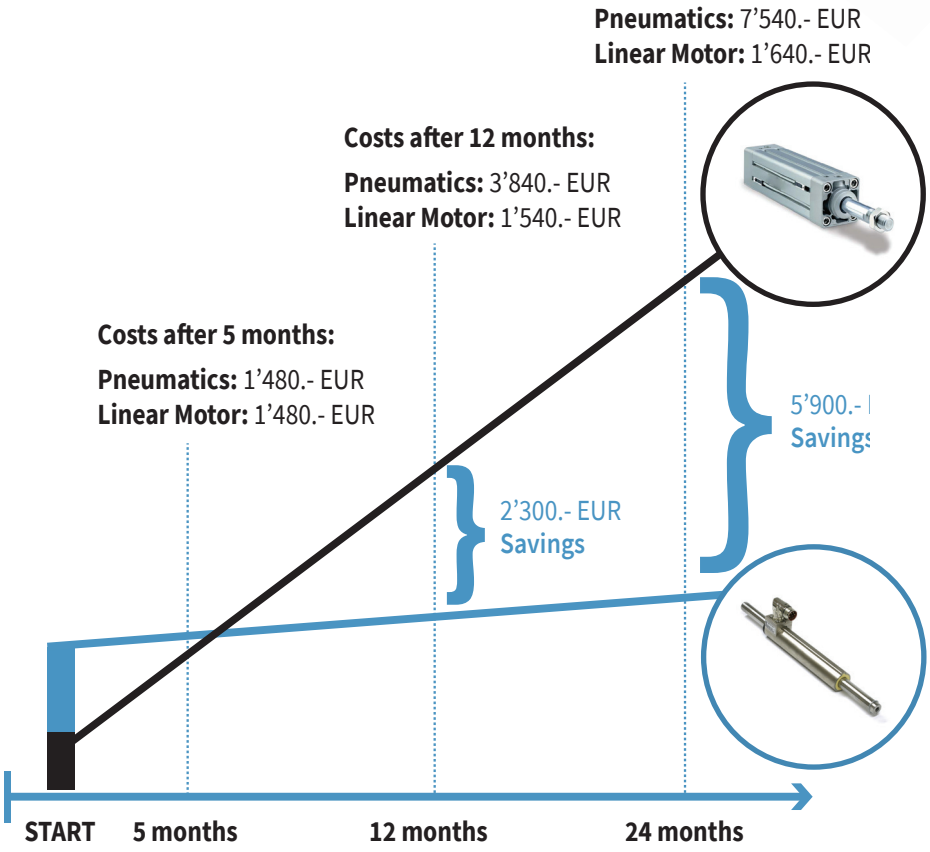
- At a current price of 0.12 € / kWh and 8000 hours of operation, **the annual energy cost is € 96.**

Pneumatic cylinder

- With production costs of 0.025 EUR / Nm^3 and an air consumption of 150.000 Nm , **the annual compressed air costs are 3.750.- €.**

Total cost comparison

A linear drive, including all components required for operation (cables, inverters, etc.), costs more than a pneumatic drive (including valves, hoses, etc.). But, due to the significantly lower energy costs, the electric drive pays for itself in less than half a year. After that, there are noticeable savings! In this example, the energy costs exceed the investment costs for the pneumatic cylinder after just three months. CO2 emissions can be drastically reduced by switching to an electric linear drive. The additional 24,000 kWh required by the pneumatic cylinder according to the example calculation correspond to an annual emission of 12,000 kg CO2 with a German energy mix of 500g CO2/kWh. The C02 balance also speaks clearly in favor of a change to electric direct drives.



More future security through innovation and flexibility

In addition to lower energy requirements and a better CO_2 balance, the electric variant also offers greater flexibility in the design of production processes and production monitoring systems. For example, electric linear drives can execute controlled motion sequences much more dynamically and with higher repeat accuracy. Because the motion profile can be freely programmed, even complex motion sequences can be implemented quickly and easily and adapted to new requirements as needed - even during operation. Linear drives are much quieter and more durable. They are insensitive to load fluctuations and can start and stop without jerks. The evaluation of the data generated in the inverter also allows various process variables to be monitored without the need for additional sensors, which can also be used for remote diagnosis of the system if necessary. Last but not least, fewer individual components are required, which are also much easier to maintain and replace compared to pneumatics, which in turn translates into lower installation, maintenance and logistics costs.

ALL LINEAR MOTION FROM A SINGLE SOURCE

LinMot Europe

NTI AG - LinMot & MagSpring
Bodenaeckerstrasse 2
CH-8957 Spreitenbach
Switzerland

+41 (0)56 419 91 91
+41 (0)56 419 91 92

office@linmot.com
www.linmot.com

LinMot USA

LinMot USA, Inc.
N1922 State Road 120, Unit 1
Lake Geneva, WI 53147
United States

262-743-2555

usasales@linmot.com
www.linmot-usa.com

LinMot®