Linear Motion System: Transport and positioning for demanding applications
The Perfect Concept – for a variety of applications

The Linear Motion System (LMS) from Rexroth is a unique technical solution for transporting and positioning materials and workpieces. Where traditional rollers, chains or belt systems reach their limits for any reason, LMS is the perfect concept. It delivers higher accuracy, allows for freely programmable individual and synchronized movements, and is faster than traditional systems. The completely non-contact drive concept particularly ensures particle-free transport in vacuum.

LMS for the highest process requirements

Whether clean room, vacuum, noble gas, at high temperatures, or in chemical areas – LMS meets the highest process requirements. Both high acceleration and low velocities can be realized easily. With its non-contact drive, the intelligent system can adapt to a variety of different production conditions. Thanks to its magnetic working principle for driving the carriers, LMS also meets all the extreme requirements in a high vacuum environment.

With LMS, the electrical components are mounted outside the process area – they do not need to be physically connected to the carriers. Since all sources producing unwanted particles are omitted, production reliability also increases. This is a decisive advantage compared with conventional roller and belt transfer systems which generate undesired foreign particles. Here, components with a highly sophisticated design must be completely enclosed and the required cutouts for motor shafts or electric cables completely sealed.

▲ With LMS, the individual movement of the carriers is performed via linear motors. The electronics are located outside the vacuum, the carriers are in vacuum.
LMS for applications in assembly technology

In traditional production, of electronic modules for example, a standard conveyor belt normally transports the products at a constant velocity. A handling robot takes them from the belt for assembly and then another robot puts them back.

LMS considerably reduces the handling effort and thus the handling times! LMS is part of the assembly process because the system not only transports the carriers but individually controls them – in the reverse direction, too. Therefore, the design of assembly robots can be much simpler because LMS already directly takes over one of the required directions of movement. In addition, more assembly robots can be placed on the same section length – resulting in significantly more compact machines.
The System – precise, scalable, adaptable

LMS – the concept
LMS is based on standard linear motor technology, whereby each single workpiece pallet/carrier is moved individually. The system can even perform complex movement patterns without any problems by moving several carriers independently of each other.

Thanks to the combination of several motors, LMS is also suitable for long production lines. Its individual scalability and flexibility provide machine engineers with a maximum degree of freedom when developing and implementing their specific application.

Extremely precise
LMS not only offers extreme positioning accuracy but also high repeatability. This is accomplished by the sensors between the single motors as well as the NYCe 4000 motion control system. Internal motion profiles facilitate the high synchronization and highly accurate positioning of the carriers. High velocities have been realized – but also very low velocities with low velocity ripples for coating processes, for example. The intelligent NYCe 4000 motion control system guarantees high performance for each motion profile.

Individually scalable
LMS adapts to every size requirement in production. The system can be very easily upgraded with several motors for particularly long production lines. The carriers can both easily accommodate high weights and move light objects with the same positioning accuracy. Several systems with different carrier sizes and weights have already been successfully implemented.

The flexible "multi-carrier concept" enables many carriers to be positioned and moved independently of each other and provides machine engineers and operators with additional possibilities for successful production.
The Linear Motion System from Rexroth not only adapts to any size requirements but also to a variety of conditions that require the highest precision. Consisting of flexible hardware components and intelligent software, LMS from Rexroth offers the ultimate in possibilities.

**Flexibly adaptable**

With LMS, Rexroth is setting standards with regard to configurability and the implementation of customer-specific adaptations. Machine engineers can plan the required material transport with precision right from the beginning of product development. The system offers the maximum degree of freedom and options. The software provides for the free programmability of all carrier movements – with I/O synchronization where required. A quick conversion to other products is therefore very easy. The mechanical system adapts to every machine. The motors and motor plates can be mounted differently – whether above, below, or next to each other.

The use of differently sized motors within the system is also possible, for example, to realize a curve. The distance between motor and magnet plate is scalable so the motors can be installed outside a vacuum chamber. In addition, various options are available for application-dependent guides: rollers, ball bushings, and also magnetic guides for a completely particle-free environment are already successfully in use.
The Configuration – arbitrary methods of transport, perfect integration

LMS from Rexroth has a flexible concept which can be adapted to a variety of different process conditions. Each application requires a different configuration. The flexibility of LMS offers you the possibility to build your system the way you want it: stand-alone or perfectly integrated into your production line.

**Perfect integration**

LMS from Rexroth is an open system which allows carriers to move from an external conveyor belt to LMS and vice versa. Even robots can be placed along the tracks so that they can perform movements for assembly tasks together with LMS.

LMS has a C/C++ or PLC interface with standard Ethernet. Since the software runs on a standard PC, other interfaces are also feasible.

**Arbitrary methods of transport**

With LMS, individual methods of transport can be realized. A combination of different tracks can also be implemented, for example, including the transfer of carriers from one track to another. The configurations illustrated here are only examples. Naturally many more options exist. Whether combined or completely different: LMS simply offers you more possibilities.

The open software architecture makes it easy to integrate the system into the automation of the entire machine and upgrade it easily using several motors for longer sections.
1. Inline transport: the carriers are transported between two conveyor belts via LMS

2. All-round transport: moving the carriers – left and right – from one track to the other

3. All-round transport with curves

2a. Variant of Figure 2: the carriers are returned by an external conveyor system

2b. Variant of Figure 2: work processes take place on the tracks above and below – a (faster) return is made using the track in the middle

- Carrier with motor for the changeover between tracks
- Carrier with transport direction
- LMS track with motors
- External conveyor system – e.g. conveyor belt
The Carrier Management Software – extremely clever

All units of the Linear Motion System from Rexroth communicate by means of a bus system with the NYCe 4000 carrier management software, which is located on a PC. The open software architecture makes it easy to integrate the system into the automation of the entire machine.

Intelligent motion control

The NYCe 4000 motion control system from Rexroth constitutes the core of extremely powerful and flexible technology. It provides you with unique freedom because it links high-performance hardware for complex process tasks with open software structures for customized movements. Furthermore, it is very easy to integrate into your automation system.
**Individual carrier management**

With the Linear Motion System you can perform a wide variety of transport tasks and movements. Whether you require free mobility for one or more carriers or synchronous movements for several carriers – the individual carrier management ensures the system fits into a specific production environment without any problems.

It goes without saying that different velocities can be realized, for example, when closing the gap to other carriers, or moving the carriers from one LMS track to another. Even inline movements to and from other transfer systems are possible. The intelligent software also makes commissioning the system incredibly simple.

**Optimized diagnostics**

The NYCe 4000 control platform offers a variety of possibilities with regard to diagnostics, error analysis, and maintenance. This means the positions of the carriers transporting the products are always known. Whether current, position errors, or motion profiles – all signals are promptly available at the same time and can be visualized using the NYCe 4000 tool set (such as NYCeScope). You can revert to "Real-time frequency analysis" when required – NYCeScope displays Bode and Nyquist figures.
Linear Motion System – technical details and components

- Synchronous linear motors with magnet plates for highly dynamic movements
- Optional magnet plates for higher temperatures and/or vacuum applications
- Optional magnet plates for higher temperatures and/or vacuum applications

**Performance**
- Independent control of any number of carriers
- Position repeatability per carrier
  - 20 μm (standard)
  - < 1 μm (with encoder option)
- Positioning accuracy (for different carriers)
  - ± 300 μm (standard)
  - ± 100 μm (with teaching)
  - ± 10 μm (with encoder option)
- Velocities from 0 to 5 m/s
- Velocity ripples (at 20 mm/s)
  - ± 5 % (standard)
  - ± 2 % (with teaching)
  - ± 0.1 % (with encoder option)
- Magnet plates
  - standard or vacuum compatible up to 10⁻⁸ mBar
  - temperature up to 70 °C (NdFeB) or 150 °C (SmCo)
- Distance between motor and magnet plate 1-8 mm
- Carrier weights from 1 to more than 1,000 kg
- Large power range from 100 W to 20 kW

- Cam roller guides for highly dynamic processes outside the vacuum, for example, in processing stations

- Rexroth ball bushings represent a high level of synchronization and precision, such as is required for photovoltaic coatings and processes taking place in a vacuum, for example

- LMS is the particle-free transport and positioning system in machines for highly demanding production processes

- NYCe 4000 LMS motion control system
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